Interactive 3D Multimedia Learning Tools In Biology

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Abstract

An interactive 3D Multimedia Learning tool in Biology is an application system to assist users in the brand new learning style for biology. Combination of the virtual and multimedia in the system can bring out the clear explanation of processes and delivery the information. Besides that, the system enables users to interactive with the system to help them in the learning biology. The web-based application also encourage sharing knowledge through distance learning between the user.

An interactive 3D Multimedia Learning tools in Biology mainly focus on Biology Cell topic with SPM syllabus. The target user for this system is mainly focus on SPM students, but this system also suitable for educators, researchers and public users. Conclusion, this is the effectiveness application in the future education field.

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Introduction

1.1 Project Introduction

Nowadays, computer-based educational system becomes more popular and important as a new approach education technology. Multimedia, one of the computer-based educational systems has discovered its power which brings the effectiveness in the education arena. Multimedia educational system is the combination of the texts, images, videos, sounds, classrooms learning style and also animation as one approach which provide an effective, attractive and invaluable way in learning. Especially the 3-Dimensional (3D) interactive computer graphics play a very important role in this computer-based learning tool because it provides a clear explanation through visualization and also demonstrated the clear biology processes in 3D. The use of the multimedia in biology bring a lot of biology information and reference which has assist to help out the educator, student, researchers, and other users who need to gather the biology information.

Interactive 3D Multimedia Learning Tools in Biology is an application system to assist users in learning biology. In recent decade, biology research was evolved concentration on the function, structure, development, and evolution at the molecular and cellular. In biology, molecular and cellular is the most fundamental yet important part because it is a basic of life. In order to make the better understanding on molecular

and cellular, multimedia assets are provide the details and visualization explanation rather than present the information in the static text.

In this system, three main processes for biology cell in SPM level are selected which are:

i) Structure of Cell

ii) Process of Mitosis and Meiosis

iii) Process of RNA Synthesis Transcription, Protein Synthesis Translation and DNA Replication.

Three of these topics are selected because these topics are the most fundamental yet important knowledge needs to understand before further on other topic in the biology. This system will have three parts which are structure of the cell, the process of mitosis and meiosis and process of transcription, translation and DNA replication. Apart from reading text, the users can interactivity through the system to produce an action of the process. With this, it may present the concept of the process of mitosis, meiosis, transcription, translation and DNA replication more effectively than static illustrations or reading of text.

1.2 Project Objective

There have several objectives to develop this Interactive 3D Multimedia Learning Tools in Biology system:

i) To develop 3D multimedia learning application for the users as learning and teaching tools.

ii) To make a clear representation about the cell structure, processes of mitosis, meiosis, RNA synthesis transcription, protein synthesis translation and DNA replication via the 3D multimedia technique.

iii) To provide the basic knowledge about cell to the users before they manage to further on to other topics in biology.

iv) To improve the traditional learning approach from static illustrations or reading text to computer-based learning environment according to the concept of smart school.

v) Enable the user to learn biology in the attractive, interesting, interactive and effective way.

vi) To encourage sharing knowledge through distance learning by using or web-based system.

1.3 Research Objective

The research objectives are as below:

i) To understand the problem in the education field and how to improve the education approach.

ii) To comprehend the problem in learning the biology nowadays.

iii) To figure out what is needed in biology education.

iv) To do research on how effective the 3D approach in learning.

v) To realized how web-based or computer-based learning can improve the traditional learning style.

1.4 Need for the Study

The needs of the study are as below:

i) Enable user to learning the structure of the cell, process of the cell and also the process in the cell.

ii) To introduce the computer-based learning approach to the student, educator and also beginner researchers.

iii) To produce an effectiveness and valuable environment for the learner to learn.

1.5 Variable and Their Roles in the Study

This system is in 3D form and it has improve the traditional learning approach from static illustrations or reading text in the classroom to computer-based learning environment which has achieve the concept of smart school. In the 3D structure, the users will be better understood more about on the cellular in biology before they further on biology.

Besides that, this system builds with the 3D interactive approach to present the clear visualization explanation and interactive for the biology information. The users enable to rotate, move around inside the cell and recognize the organelles by using the mouse. This kind of vision system certainly will help the students and researchers to collect and process the information and then form the concept from the information that have present. With this, they have a lively and attractive learning environment and this will have a long term memory for the student to remember the concept through the visualization explanation.

In addition of using multimedia, this system has support other interactive elements such as the animation, audio, text, images and video. This will help users to understand and remember the information of biology.

1.6 Project Scope

The scope in this project is:

i) This system is focus on the SPM biology syllabus, so all the titles selected are from SPM level biology. However, this tool also suitable to anyone like who would like to know more about the structure of cell, processes cell division and processes insides the nucleus cell.

ii) Focus on the several selected chapter for secondary biology titles which are structure of cell, process of mitosis and meiosis, process of RNA synthesis transcription, protein synthesis translation and DNA replication.

iii) This system is an online system and using web-based application. The navigation, interaction and functionalities of the system should be clear and user-friendly to provide the clear learning environment to the user.

1.7 Project Problem of Statement

Below are the several problems that have been identifying:

i) Educational Problem Statement

- During the class, only the teacher speaks, and the student passively listens. Although sometime teacher will do some interaction among the student but there still cannot make sure all the student can get the knowledge that have been teach. When they cannot understand, their best ego defense is to stay together with the strategies that have been successful them in the pass (D.Novak, 2003). In fact, students were memorizing all the knowledge has been taught to prepare the exam (Alan, Phillip and Brian, 1999).
- Using textbook for teaching science subject is no suitable for practical or experiment. Textbook only provide one pathway through to give knowledge, but usually this pathway may make sense to the writer but it can never be optimal pathway for all learner (D.Novak, 2003). Therefore, students are facing the problem to understanding the biology process which are complexity which cannot be present a clear

explanation through the static illustrations or text. Educators also feel the same during the teaching.

i) Biology Problem Statement

- Recent decades, most of the beginner researchers often struggle in understanding and learning the biology because they feel hard to imagine the processes in 2D while the real process is happen in the more complexity (Philip, Christina, Roxanne, Lisa, John, Brian, Jeff & Alan, 2005).
- Current understanding of many cellular pathways is incomplete or wrong (Branley, 2004). Before they are involve in the further biology process, they need to understand the most basic part for the biology which is cellular and the process of the cell before they further on the other research.

1.8 Proposed Solution

The proposed solution for the main two problems is from above are:

i) Education problem statement solution

- Provide an effectiveness learning tool to achieve the aim of the smart school.
- 3D interactive and animation learning tools is the ideal learning tool and it has improve the traditional learning approach from static illustrations or reading text in the classroom to computer-based learning environment which has achieve the concept of smart school. By using 3D interactive and animation, student has a lively and attractive learning environment and this will have a long term memory for the student to remember the concept through the visualization explanation.

ii) Biology problem statement

- Provide the clear and understandable education for the student and researcher to let them have a clear conceptual for certain biology process.

1.9 Target User

These interactive 3D multimedia learning tools in biology build for the several users.

They are:

i) Educator and student

- They are including the student and educator in the biology class.

ii) Researchers

- Especially for those research who still fresh in the molecular and cellular research.

iii) Public users

- For those public user who need to know or to get the general information about molecular and cellular.

1.10 Definition of Terms

1. The user
   - The people who are using this system.
2. 3 Dimensional
   - Having a three-dimensional form or appearance and commonly used in computer animation, virtual reality, environment, etc
3. Interaction
   - Interaction is a response experience in which both actor and reactor are engaged in a mutually affecting experience. This means that the system is comprised of two interactive partners.
4. Multimedia
   - The use of computers to present text, graphics, video, animation, and sound in an integrated way.
5. Learning tools
   - Tools that allow instructors to manage a student's progress over a network through a series of required modules for the completion of a course of study.

6. Biology

   - The science of life. It is concerned with the characteristics and behaviors of organisms, how species and individuals come into existence, and the interactions they have with each other and with their environment.

7. Cell

   - The structural and functional unit of all living organisms.

8. Mitosis

   - The replication of a cell to form two daughter cells with identical sets of chromosomes.

9. Meiosis

   - The reduction division process by which haploid gametes and spores are formed, consisting of a single duplication of the genetic material followed by two mitotic divisions.

10. DNA Replication

    - The use of existing DNA as a template for the synthesis of new DNA strands. In humans and other eukaryotes, replication occurs in the cell nucleus.

11. Transcription of RNA Synthesis

- The synthesis of RNA from a DNA template. The process of making RNA from one strand of the DNA molecule.

12. Translation of Protein Synthesis

- Translation is the second process of protein biosynthesis (part of the overall process of gene expression). In translation, messenger RNA is decoded to produce a specific polypeptide according to the rules specified by the genetic code.

1.11 Limitation

The limitation of the system as below:

i) This system is the web-based system, so the user only can access this system if they have a network.

ii) This system is targeted to the SPM level. Therefore, the information have cover is in the SPM level. The ease of use is considered.

iii) This system is concentrates more on basic structure of cell and process of mitosis, meiosis, transcription, translation and DNA replication.

1.12 Project Timeline

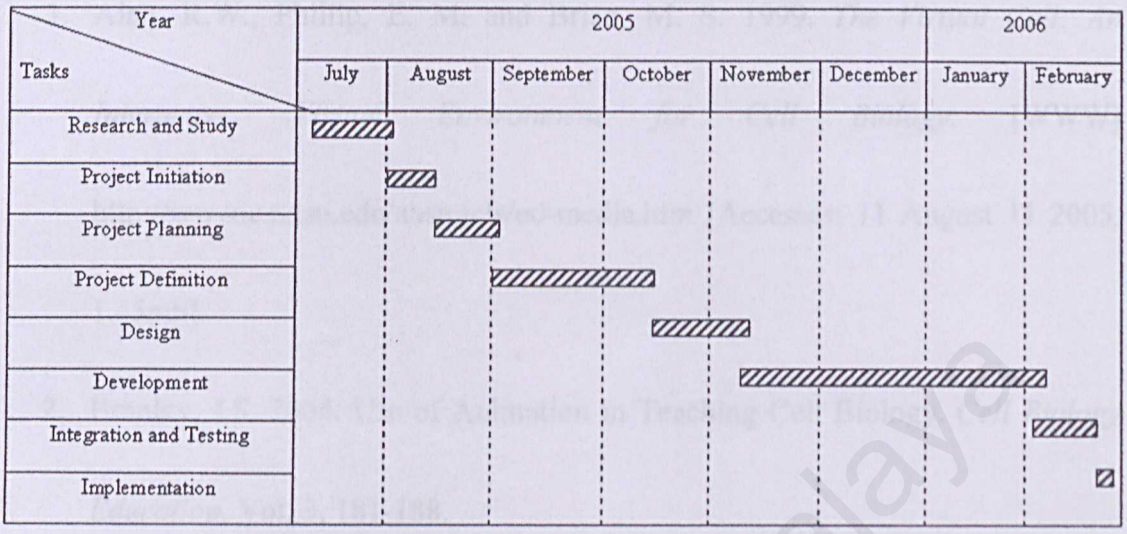

Figure 1.1: Project timeline for 3DiC system

1.14 References of Chapter 1

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Chapter 2
Literature Review

2.1 Introduction

Literature review is a various forms of research synthesis involve the analysis and integration of other forms of research. However, literature review in this chapter is mainly focus on the education issue, the technologies of the system and a few similar learning applications to estimate its effectiveness.

2.2 Research on Education Malaysia Today

2.1.1 Education Malaysia Today

Malaysia government always gives the priority in the education because education is an important factor in achieving the general aims of society. In order to achieve this aim, the Malaysian government has placed a special priority on improving the educational quality especially in science programs and a lot effort are made to increase the number of student in this area of study (Azina and Ang, 2005).

In Malaysia, students have been provided 11 years of free schooling for the public sector. Thus, children between the ages of seven and 12 have to register and enroll in primary school. The national education systems conduct education from pre-school to higher education and are group as below:

i) Pre-school education from age 5 (for 2 years).

ii) Primary education from age 7 (for 5 to 7 years).

iii) Lower secondary education from age 13 (for 3 years).

iv) Upper secondary education from age 16 (for 2 years).

v) Post-secondary (Form Six/ Matriculation) education from age 18 (for 1 to 2 years).

vi) Tertiary education: Undergraduate studies from age 20 (for 3 to 5 years); mater degree or PhD studies, after acquiring the first bachelor degree (for 1 to 5 years).

Malaysia education is using curriculum approaches. Curriculum is the word from an ancient Latin term which mean "running course". It is a plan for selecting content and organizing learning experience with the purpose learning with understanding. This education has several objectives such as mastery the facts and concepts for the knowledge, require student to memorize, use the principles or generalizations to solve the problem, enable to understand not only the content but also the structural form for the content, enable to change the way of the learner thinking and to use creativity, and lastly, enable to make the judgment not just give the opinion.

There have six principles for curriculum which are equity, curriculum, teaching, learning, assessment and technology (David, 1989).

However, most of the Malaysia school still did not really apply curriculum concept and remain the memory-based learning. The main problem is Malaysia school still does not have any standard lecture or laboratory format (Alan, Phillip and Brian, 1999). During the class, only the teacher speaks, and the student passively listens. Although sometime teacher will do some interaction among the student but there still cannot make sure all the student can get the knowledge that have been teach. When they cannot understand, their best ego defense is to stay with strategies that have been successful them in the pass (D.Novak, 2003). In fact, students were memorizing all the knowledge has been taught to prepare the exam (Alan, Phillip and Brian, 1999). Beside of that, using textbook for teaching science subject is no suitable for practical or experiment. Textbook only provide one pathway through to give knowledge, but usually this pathway may make sense to the writer but it can never be optimal pathway for all learner (D.Novak, 2003). Meanwhile, laboratories are intended to afford students with an interactive, experimental experience, but in reality these are usually rigidly structured by the laboratory outline where the intended outcome is known and the procedure is inflexible (Alan, Phillip and Brian, 1999).

One problem with teaching biology is our current understanding of many cellular pathways is incomplete or wrong (Branley, 2004). Further more, beginner researchers struggle in understanding and learning the biology because they feel hard to imagine the processes in 2D while the real process is happening in the more complexity (Philip, Christina, Roxanne, Lisa, John, Brian, Jeff & Alan, 2005). For science student, they need an interactive and exploration-based experience that teaches basic principle so that they can understand before further on the more complexity topic. An active learning alternative is providing the virtual environment where learners can experience their education in a "learning-by-doing" way (Alan, Phillip and Brian, 1999). The leak of facilities in education also becomes a main problem in education field.

2.1.2 Information Communication Technology (ICT) in Education

In 1995, the introducing of Multimedia Super Corridor (MSC), one of the projects in order to achieve Vision 2020 is the main factor to bring the Information Communication Technology skill to Malaysia. In order to support the country's ICT master plan and in line with the country's to fulfill Vision 2020, the education system

has to be transformed, to develop the potential of individual in the intellectually, spiritually and physically balanced and harmonious.

The long-term efforts of the Malaysian government in the field of education are to provide the development of human resources include programs at all levels of education. For primary and secondary level education, government had built the new school with the particular emphasis to science and IT learning facilities. Besides that, government also increased educational support programs, revising the syllabus for mathematics and subjects in English from 2003, introducing Computer Literacy Program and computer aided learning methods and incorporating Computers and Multimedia in Teacher training (Ramasamy, Chakrabarty and Cheah, 2002).

In ICT education, government Malaysia was concentrates on developing new media as learning tools in the service of richer curriculum approach, more effective learning way, more systematic organization structure in schools, have a stronger link among the school and society. With this implemented computing and communications, Malaysia education has the potential to revolutionize education and can be empowerment of disenfranchised learners as profoundly as information technology.

The concept for the ICT in education is system that can gather the information, management, manipulation, access and communication in the various forms. There are three policies for ICT education which are:

i) As an enabler to reduce the digital gap between the school.

ii) To emphasizes the role and function of ICT in education as a teaching and learning tools.

iii) To emphasizes using ICT to increase productivity, efficiency and effectiveness of management system.

2.1.3 Introduction of Smart School

In 1997, Smart School concept has been brought as one of the seven flagships of the Multimedia Super Corridor ICT Application and started implement at 1999 where 90 schools have been selected act as a pilot of Smart School Plan (Cloke and Sharif, 2001). The aims of Smart School is systematically change the teaching and learning processes in schools using information technology to support and enhance teaching-learning. With this, the student will be taught to be more proactive, analytical and creative.

The concept of the smart school is teachers are as a facilitator, organizing and preparing a conductive and stimulating learning environment for student based on the

given curriculum. On the other hand, students are responsible to chart out their own way in learning and taking charge of their learning process. In directly, enhances students' self-learning, emphasize student-centred learnig, active knowledge construction, as well as critical and creative thinking (Ng, Bakar, Roslan, Wong, Rahman, 2005).

2.1.4 How do Teacher to be trained?

As a developing country, it is the inspiration of our leaders of higher level to achieve vision 2020. For this vision, education is one of the variety programs are planned through five years strategic planning. This is because education is the main criteria in the judge of the developing nation. So, the successful of one country is depending on the success of its education system.

Teacher was playing the important role in the education. To produce teachers who have the same vision and fulfill the National Philosophy of Education, they need to be preparing with the skill of using Information Technology. Teacher Education Division (TED) is one of the programs that has planned and carried out a strategy increasing the facilities, curriculum and also training programs by introducing the skill in ICT for every individual who is involved in teacher training in Malaysia. Through

the efforts it is hoped that teachers are able to perform competently and excellently in this era of globalization (Mohamad, 2001).

2.1.5 Research on Web-based learning

World Wide Web (WWW) was changing the way of teaching and learning that have been conducted .Web-based learning is using web as a delivery, communication and interaction (Alomyan. and Au, 2004) between student and the system. The main advantage of web-based learning is the web lies in its non-linear interaction, so student have more control in their learning pathway (Alomyan, 2004).

From the student perceptive, web-based learning has a several benefit such as greater motivation to work, better understanding for the course material, learn more and better, provided the higher quality of education, convenience and flexibility, better communication between student and professor, more student active participation in discussion and communication, and have a immediate and extensive feedback (Hirschheim, 2005).

However, it also bring a numerous of disadvantages like difficulty developing student friendship, lack of feedback and instructor interaction, confusion about class requirements, lower levels of satisfaction and interest, more attendance lapses and

others (Hirschheim, 2005). Table below shows the advantages and disadvantages for web-based learning:

	Advantages	Disadvantages
1.	Geographic independence which mean no longer restricted to the physical building of learning institution.	Delivery information but not delivery learning.
2.	Learning is anytime and anywhere.	Cannot identify individual student's problems.
3.	Information can be changed and update at anytime.	Payment of the server support or implementation of web-based delivery platform cost
4.	Allow to refreshing as many time as possible.	-
5	Increased communication via forum and online discussion.	-

Table 2.1: Advantages and disadvantages web-based learning

2.2 Research on Interactive Multimedia

2.2.1 Multimedia

Multimedia defined as a combination of multiple media and hypermedia to convey information. Multiple media here is combination of different media such as text, visual arts, audio, video, animation and others. Meanwhile, hypermedia is the link and the objects. In the other words, multimedia also refers as computer media. As the information is presented in various formats, multimedia makes user easier and faster to grasp the information in digital formats (Multimedia, 2001). Multimedia such as CD-ROM or website is more than concurrent presentation medium. Multimedia design has two main components which are:

i) Conceptual design

Involve in content structure and interactions.

ii) Presentation design

Provide the life to the conceptual design, it exploit human perception feature.

2.2.1.1 Multimedia Elements

i) Text

Text is the fundamental yet important element to deliver the information. Text can add the visual effect by using Adobe Photoshop. Text-based information can be gathering through book, internet and etc.

ii) Graphic

Graphic is a visual symbol that can incorporate into multimedia in the form of designs or photos. Graphic can be gathering through the internet, book references, resources CD, and camera, scanner and others. Application such as Adobe Illustrate and Adobe Photoshop can used to create original graphic.

iii) Sound

Sound represents the audio that can be added into the multimedia presentation. Original sound can be recorded by using the certain application such as Sound Forge. By using this application, different format of the audio can be created.

iv) Animation

Graphic with the movement are refers as the animation. Usually, animation graphic is in the GIF format. Macromedia Flash and Swish Max application also can create the animation.

v) Video

Video can be incorporated into a multimedia project as AVI format movie or other format.

2.2.2 Interactive Multimedia

Interactive multimedia is an application that allows users to participate instead of just sitting by as passive recipients of information. In interactive multimedia, users can interact with the multimedia system and control the result of the outcome of the multimedia system (Neo, Ken, Mai, 1999). In other words, interactive also refers as the system accepts any input from a user; while in the other hand interactive computer systems are the program that allows the users to enter data or commands. In the multimedia, interactive learning environment make sense when the user can navigate through it, select relevant information, respond to question using computer input

devices to solve problem, create knowledge presentation, collaborative with other around the worlds.

2.2.3 3-Dimensional (3D)

3D means the object have volume and may be measured and described using three orthogonal directions. 3D always refers as 3D graphic or 3D animation. 3D graphic is a displayed representation of a scene or an object that appear to have three axes of reference: height, width and depth. 3D animation is refers to render the shaded, modeled shapes that have an appearance of depth with the movement. Elements of 3D imaging include alpha blending, filtering, interpolation, fogging, MIP mapping, perspective correct and texture mapping.

2.2.4 Advantages of Multimedia

The computer-based multimedia has a several advantages as below:

i) Non-threatening learning environment

Multimedia learning tools provide a non-threatening learning environment to let them explore and gain their own knowledge; to practice and testing

their own skills at their own place which can encourage the self-regulated learning.

ii) Accessibility

The computer-based and web-based system allows the user can access at anytime and anyplace.

iii) Motivation

3D interactive system provides an interesting and meaningful environment for the student to self-regulated learning. Effective uses of the media provide appropriate guidance to the students in the learning process.

iv) Cost-effectiveness

3D with the web-based learning system is approximate half cost of the video learning tools.

2.2.5 Disadvantages of multimedia

i) Need the high processor speed, memory, hard-disk space and data throughput.

ii) The sound, images or 3D animation and movie element need higher bandwidth if compare to the text element.

2.3 Research on Current Existing System

2.3.1 The Virtual Cell (http://www.ibiblio.org/virtualcell/tour/cell/cell_mito1.htm)

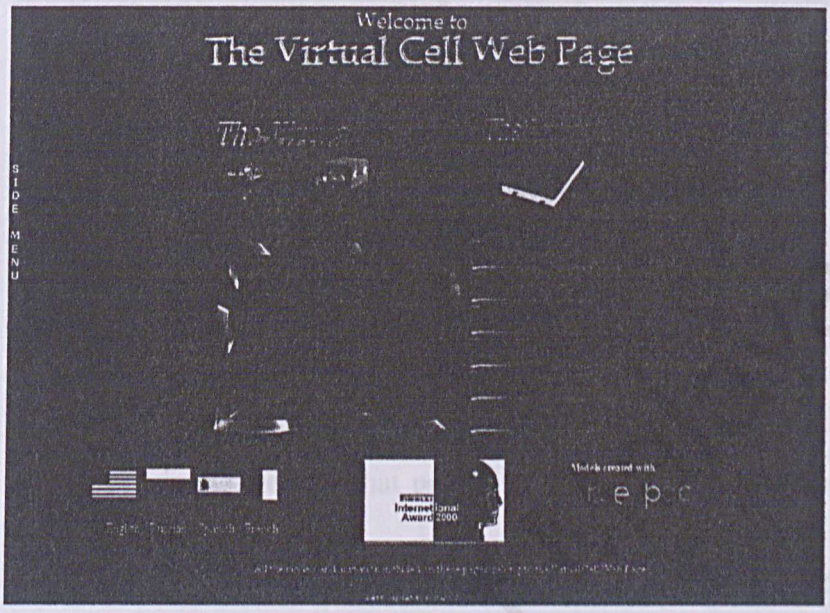

Figure 2.1: Main page of The Virtual Cell

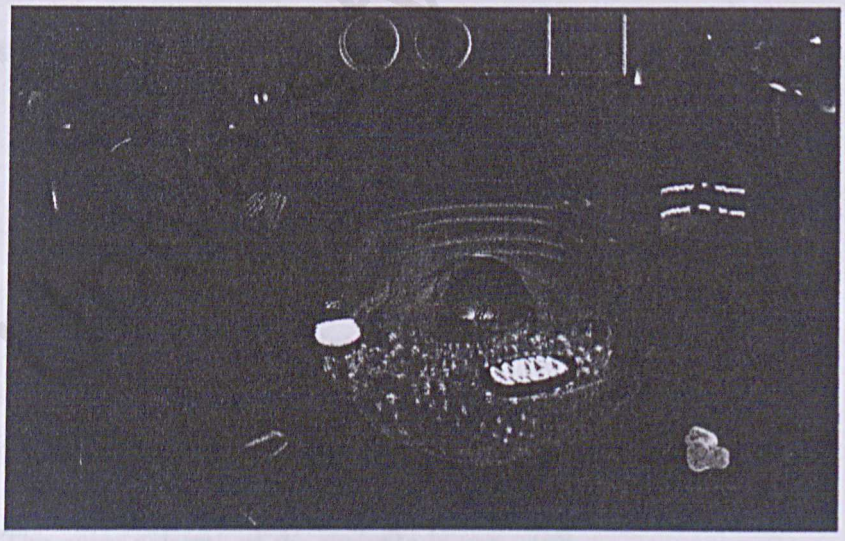

Figure 2.2: Content of The Virtual Cell

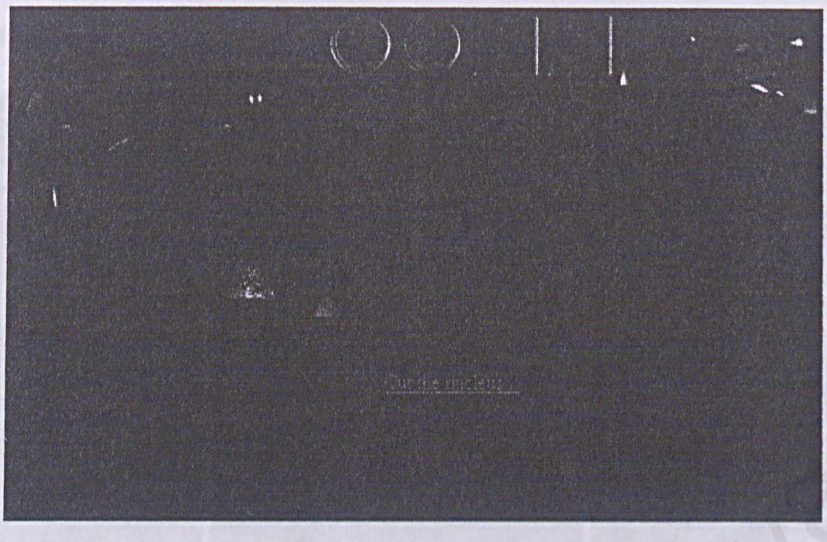

Figure 2.3: Content of The Virtual Cell

The virtual cell is the website that provides the biology information in the 3D form. In this website, there have two parts which is the virtual cell tour and the virtual textbook.

Position Reviews of the system

i) Provide 3D interaction feature to let user understand more about the cell.

ii) Enable the user to download the information.

iii) Providing the clear and detail about the cell.

Negative Reviews of the system

i) The color scheme of the website is very dull.

ii) Menu of the website is not user-friendly.

iii) No exercise, tutorial and any process that happen in the cell.

2.3.2 Cell Alives! (http://www.cellsalive.com/toc.htm)

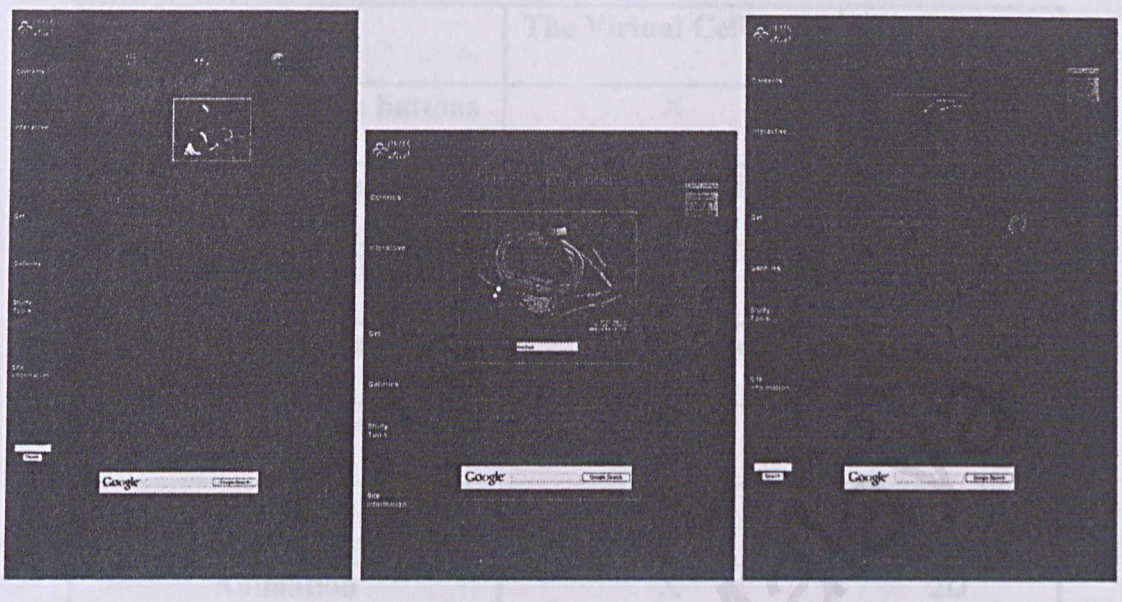

Figure 2.4: The webpage of Cell Alive!

Cell Alives website is another website that provide the 3D interactive of the cell.

Position Reviews of the system

i) Provide the 3D cell information.

ii) Clear detail and information are provided.

iii) Provide the 2D animation of mitosis and meiosis that happen in the cell.

iv) Enable the user to download the information.

Negative Reviews of the system

i) There are no interactive between the user and system.

ii) Color scheme of the website is not attractive.

iii) Do not have any exercises and tutorial for the user.

2.3.3 Comparison of Similar Systems

	The Virtual Cell Tour	Cells Alive
User friendly menu buttons	X	X
3D system interaction	3D + interaction	3D
System color scheme	Dull	Dull
System information	Clear + Detail	Clear + Detail
Tutorials & Exercises	X	X
Download	□	□
Animation	X	2D

Table 2.2: Comparison of similar system

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Chapter 3
Methodology

3.1 Introduction of System Development Life Cycle (SDLC)

System Development Life Cycle (SDLC, 2001), also know as Application development or Information System Development, is the process of developing information systems through investigation, analysis, design, implementation, and maintenance (SDLC, 2001). SDLC methodology is applicable, is a systems approach to solve the system problem once the system is being developed, modified, edited, or deleted and also is a conceptual model used in project management to describe the stages involved in information system development project from an initial feasibility study through maintenance of the completed application. SDLC has several phases, each phases comprised of multiple steps. Below are the steps that are involved in the SDLC:

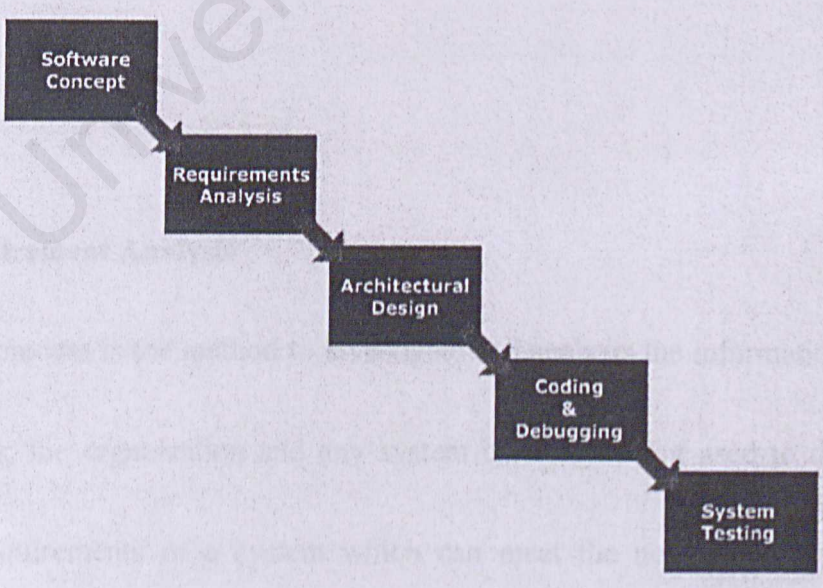

Figure 3.1: SDLC Phases

3.1.1 Software Concept

The first step of SDLC process is software concept. This step is to identify the need for a new system. This process also will determine the business problem, existing opportunity and conducting a feasibility study to proposed a solution with the effective cost and efficient developing a project plan. This process might involve information system people and end users who will lend the help for information system people to turn up an idea or suggestion for enhancement or modifying the system, or only involve information system people. Management is needed to approve the concept of ideas before its development. Comparison, observation and determination have been done during the research on the existing educational courseware (CD-ROM based) and also the existing online educational courseware and others which are related with this system.

3.1.2 Requirement Analysis

This process is the method to investigate and analysis the information needs of the end users, the organization and any system currently being used to develop the functional requirements of a system which can meet the needs of the users. This process also analyzes the intended use of the system and specifies. Then functional and

data requirements are connect the functional requirements to the data requirements which may reveal new insights into the overall information system requirements. The requirements need to be recorded in a document, email, user interface storyboard, executable prototype, or in others format as a reference throughout the system development process to ensure the developing project is well suit with user needs, expectations and requirements. The activity of this phase is includes:

i) Collecting data and information.

ii) Analysis system requirement.

iii) Ranking the requirement.

iv) Generating alternative and selecting.

The important part in this phase is on determined what functions must be performed rather than how to perform those functions (Information Resource Management, 2003).

3.1.3 Architectural Design

When requirement analysis is determined, the functional requirements of the proposed system which are suits for the planned system specifications of the hardware, software, people, data resources and the information products will serve as a blueprint

for the system and helps detect problems before these errors or problems are built into the final system. Then, transform the detailed, defined the requirements into complete, detailed specifications for the system to guide the work of the next phase. In this phase, the information system people will review their work with the users so that the system functional, physical, interface, and data requirements will meet the users' needs.

3.1.4 Coding & Debugging

Coding and debugging is the act of creating and developing the final system. This phase is done by information system people to convert the deliverables of the architectural design into a complete information system (Information Resource Management, 2003) which contains activities for building the system, testing the system, and conducting functional qualification testing and to ensure the system functional processes satisfy the functional process requirements in the Functional Requirements Document (FRD). The coding and debugging is the process for developing and preparing for the system to operate. So, coding and debugging are required for the interfaces that link the software to existing systems that must communicate with the new system. Then, the system will be ready for the activities of the system testing phase.

3.1.5 System Testing

The final system must be tested to prove and evaluate its actual functionality satisfies in relation to expected or intended functionality (Information Resource Management, 2003). There are some tests will be conducted such as subsystem integration test, system test, security test and users participate in acceptance testing. Some other issues to consider during this stage would be converting old data into the new system, training employees to use the new system and testing security controls before system implementation. At the end, the end users will be determining whether the developed system meets the intended requirements, and the extent to which the system is actually used.

3.2 Benefits of the Good Methodology

The need of the methodology in system development is to establish a productive system development environment. By using the consistent techniques, standards and deliverables, a methodology can improve the productivity of the development and quality of the system (Bosman, McLeod & Tanfield, 1992). A good methodology consists of attributes that satisfy both the technical and managerial aspects of systems development. It is importance to choose the good methodology which is suits with the project that develops because it should support the workflows that make sense in the context of developing a quality system. A good methodology will provide several benefits as below:

i) Have standard frameworks during developing so that the system develops in the right track and consistently.

ii) Providing understanding system requirements.

iii) Producing a high quality and timely result.

iv) Enable to identify the error during developing.

v) Facilitate project management.

vi) Facilitate the progress toward greater effectiveness, efficiency and reliability (Standford University, 1997).

3.3 Characteristic of a Good Methodology

Good methodology has the characteristic as below:

i) Cover all phases of the system development.

ii) Well quality documentation.

iii) Relevant to the type of application being developed.

iv) Easy to use for average analysis and programmers.

3.4 Waterfall Model with Prototyping

Waterfall model with prototyping have been chosen as the system process model because waterfall model divided into several stages, offering visibility of each process. In waterfall model, each development stage has to complete before further on the next stages. This model also in a well documented process. With the addition of the prototype model as the sub-process, it can be reviewed and tested to check it functionality and requirements. With this, error and problem can be detected at the early stages and avoided. Below is the waterfall with prototyping model:

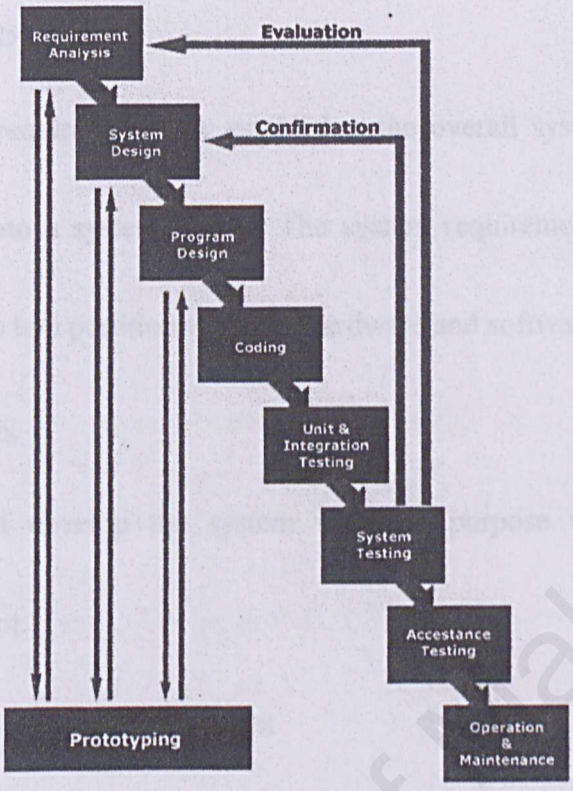

Figure 3.2: Model Waterfall with Prototyping

3.4.1 Stages on Waterfall Model with Prototyping

Below are the stages that involve in the waterfall model with prototyping:

i) Requirement Analysis

The system's services and functional are establish to investigate and analysis the information needs of the end users. User requirements are defined and specified as an outcome of this stage.

ii) System Design

The user requirements are establishes the overall system architecture and mapped into a system design. The system requirement design have been divide into two partition which as hardware and software.

iii) Prototyping

Process of develop the system with the purpose to validate the user requirement.

iv) Implementation and unit testing

In this stage, system's program and component has been test individually and each of testing involves verifying each unit is meet the end user's needs.

v) Integration and system testing

After the program and component of the system is tested, the whole system then is integrated and tested. Outcome of this stage is validate and verified operational system.

vi) Operation and Maintenance

In this stage, system is been put as a practical use. Correcting error and improvement have been done to maintain the functionality of the system.

3.4.2 Advantages of Waterfall Model

The advantages have been bringing by waterfall model such as:

i) Easier for other people to understand the coding that has been writing.

ii) As a blueprint for the developer to develop the system stage by stage.

iii) Reducing the project developing cost and cost.

iv) Easy to associate and identify each milestone with it's deliver.

v) To avoid encounter same error during the system developing.

3.4.3 The Advantages of Waterfall Model with Prototyping

The advantages that have been bringing by waterfall model with prototyping are:

i) Before starting the system developing, the entire requirement and functional of the system can known in more detail and advanced through the model.

ii) Allows the users to see how the system works start from early stage.

iii) Enable the developer to go back the previous stage if their figure out the improvement or incompleteness for the specifications.

iv) Provide the several division of stage must be completed before further on to the next stage of the system.

v) Encourage the participation of users to collect the system requirement during the prototyping were conducted.

3.5 Requirement Gathering Method

3.2.1 Quantitative

Quantitative research is the most common encountered as part of formal or conclusive research used when conducting exploratory research. The data is usually gathered using more structured research instruments and the results provide less detail on behavior, attitudes and motivation. The results are based on larger sample sizes that are representative of the population which can usually be replicated or repeated, given it high reliability. Quantitative research techniques include observation technique, experimentation and survey technique.

3.2.2 Qualitative

In Qualitative research, data is usually gathered using less structured research instruments compared to quantitative research. The findings are more in-depth since they make greater use of open-ended questions and the results provide much more detail on behavior, attitudes and motivation. The research is more intensive and more

flexible and the analysis of the results is much more subjective. Examples of qualitative research method are in-depth interview and case studies.

Below are the information gathering techniques that were being used for this Interactive 3D Multimedia Learning Tool in Biology system:-

i) Survey and Observation & Questionaire

Survey was done to observe the existing interactive 3D multimedia learning system currently on the Internet and to analysis their advantages and disadvantages as well as making comparison and improvements on them. Questionnaire is being distributed to the system's targeted users in order to collect feedbacks and details on user's demands and opinions. The questionnaire also intended to find out the current problems happening in education field today.

ii) Internet

Search engines such as Google and Yahoo were being used to search for necessary information and details for the system. Details needed such as the definitions for particular technical keywords of the system, existing system comparison and journals and articles finding are being obtained from the internet.

iii) Document room

The document room in Faculty Science Computer and Information Technology provides a number of system documentations done by past years students which is a great place to gain reference and ideas while planning for the system features and structure building and development.

3.6 Survey Outcome

Below is the result of the survey done for 40 students at SMK Bukit Bandaraya:

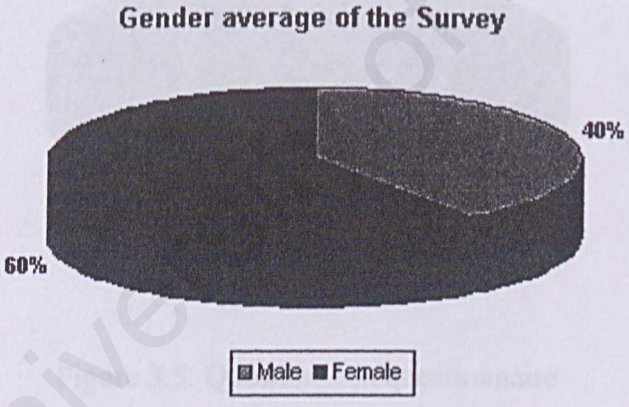

Figure 3.3: Question 1 in questionnaire

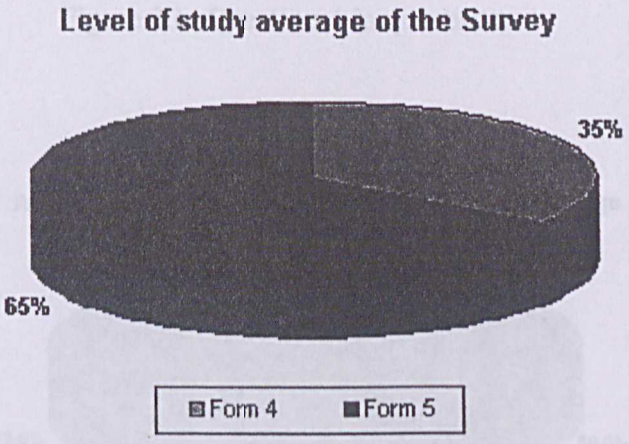

Figure 3.4: Question 2 in questionnaire

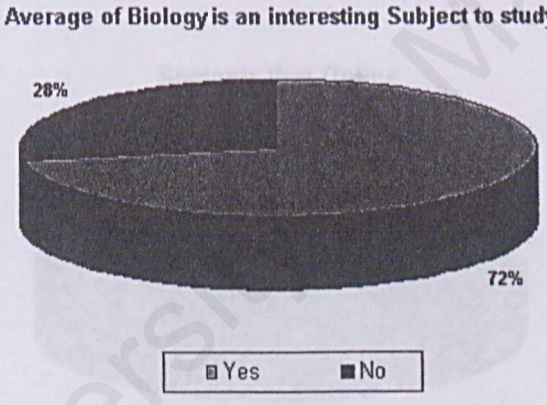

Figure 3.5: Question 3 in questionnaire

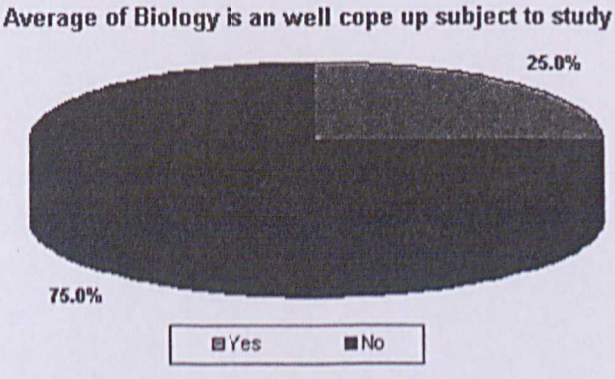

Figure 3.6: Question 4 in questionnaire

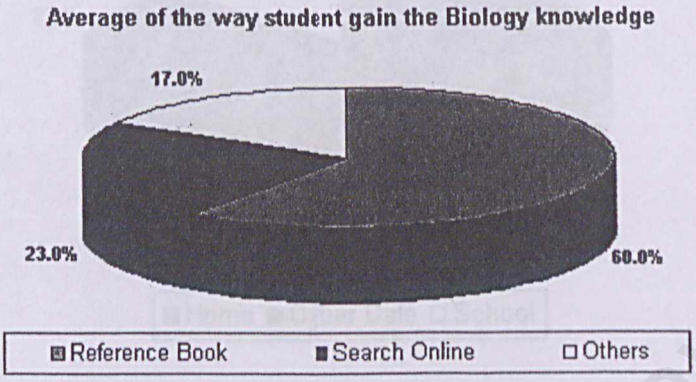

Figure 3.7: Question 5 in questionnaire

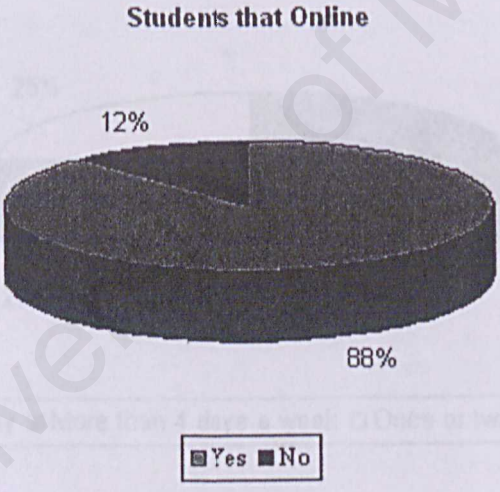

Figure 3.8: Question 6 in questionnaire

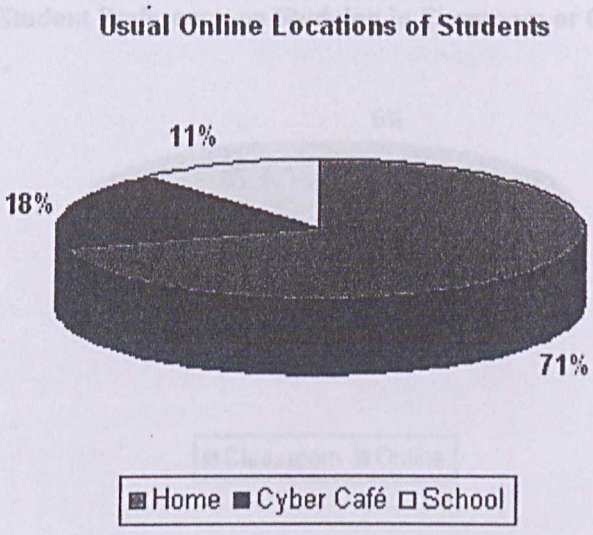

Figure 3.9: Question 6.a in questionnaire

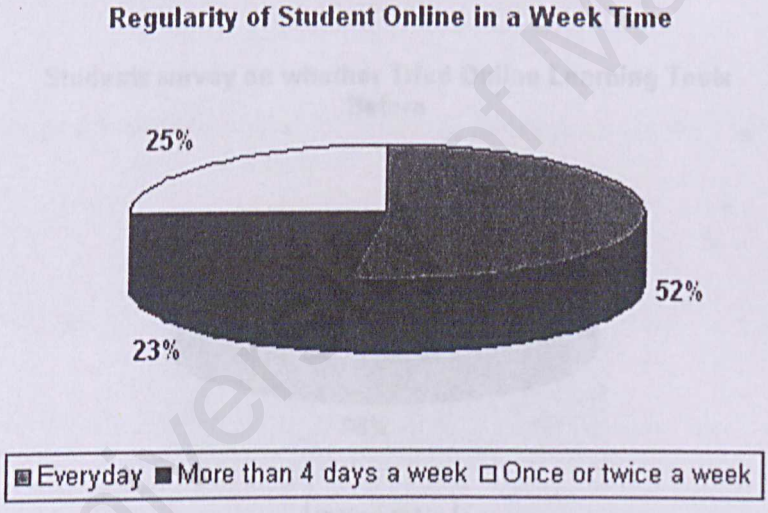

Figure 3.10: Question 6.b in questionnaire

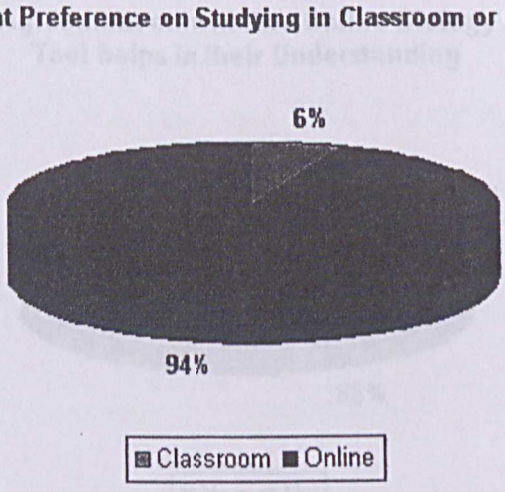

Figure 3.11: Question 7 in questionnaire

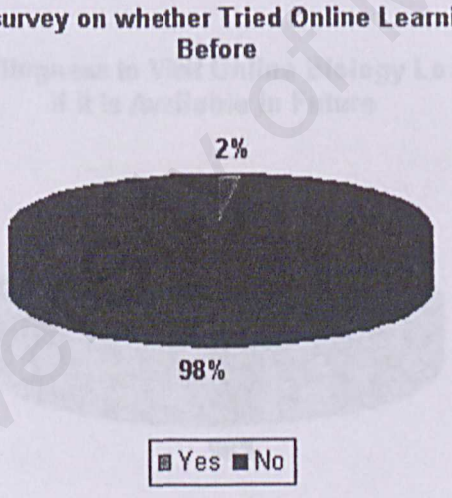

Figure 3.12: Question 8 in questionnaire

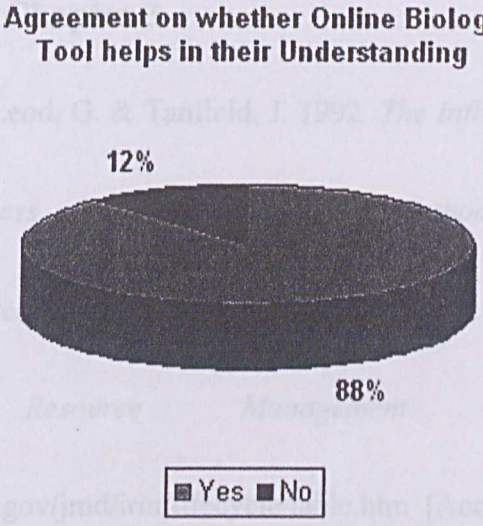

Figure 3.13: Question 9 in questionnaire

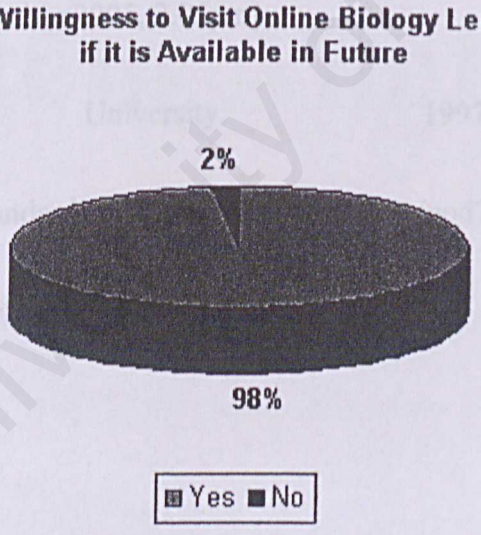

Figure 3.14: Question 10 in questionnaire

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Chapter 4
System Analysis

4.1 Introduction of System analysis

System analysis is including all phases of the methodology, information gathering and analysis system requirements before build out the final 3DiC system. A requirements analysis is to help identify a better course of action and make a better decision (Heylighen, Joslyn and Turchin, 2002) to define the system going to develop. Usually, system analysis is combining with identification and re-identification, method of courses of action, examination of the matter of costs, benefits, risks, and presentation of system framework from among the alternative. Therefore, user's studies are needed to be conducted to gather information before start developing the system. Hence, the information analysis and the system synthesis are closely related.

4.1.1 Information gathering

The system analysis process starts with the information gathering. This session provides an overview of methods which had been implemented to collect information throughout the system planning process. This process is very important to gather the different type of information and determined the solution and problem of the system. Several different information gathering methods are used in the analysis process to

ensure the success in conducting research of the project. Below are the techniques were used to gather information:

i) Internet Research

Keywords searching were used to gather the information about the system concept, software development process, methodology and others technologies for comparisons purpose. Some useful search engines are:

i) http://www.google.com

ii) http://www.yahoo.com

iii) http://www.msn.com

ii) Research and site visit

Research via the World Wide Web was used to analysis and studies the various existing online educational courseware and website. Weakness and strength of the existing current system have been identify and studied. Besides that, a lot of attractive website had been explored during research in order to get an idea on developing this system.

iii) Brainstorming sessions

This method was used among supervisor, partner, course-mates, and friends to collect the different perspective ideas, suggestion and users' needs.

iv) References

Materials such as books, newspapers, magazines, thesis and e-book were review in order to get an idea and information to do the comparison. The thesis outlines that shown by supervisor has give a clear concept to organization the format, heading, and content of the report. Plenty of time spent in the document room to refer the previous year thesis to gather more information.

v) Questionnaire

The survey form had been conducted through questionnaires. Through the survey, users' needs and require can be identified. The format of the questionnaire for the pre-define responses had been fixed to make the results easier to tabulate.

vi) Interview

An interview has been conducted to better understanding about what users' needs. The main purpose of the interview is to identify the problem facing by the educator and student in education and get an idea what standard module needed to include.

4.2 Requirement Definition

Requirement engineering is a process of establishing the services that are required of the system and the constraints under which it operates and is developed (Sommerville, 2004). There are two type of requirement which is user requirements and system requirements. User requirements are the statement of what services the system is expected while system requirements are set out in detail for the system's function, services and operational constraints. Basically, system requirement was classified into functional requirements, non-functional requirements and domain requirements.

4.2.1 Functional Requirement

Functional requirement capture the intended behavior of the system (Ruth & Dana, 1999) and describe what the system supposed to do by defining the system functions or services that content in the system. It also refers as statements of services the system should provide (Sommerville, 2004), how the system should behave in particular situations. In 3DiC, it content five modules which is Home, About us, 3DiC, Animation, Tutorial and Admin sessions.

i) Home

This module is the main page for link to the other module. Therefore, this page content 4 link which link to About us, 3DiC, Animation and also Tutorial. Besides that, this page also provides the register link and login for the user.

ii) About Us

This module is content all the information about the background of the system. The information is including system description, the objective and vision of the system, system screenshot, system sitemap, frequency answer and question and feedback.

iii) 3DiC

This module is the main part of the whole system. In this module, 3D interactive cell model and clear description have been provided to let the users learn more about cell. In this module, there are content 3D model of bacteria, virus, animal and plant which can be interact. Besides that, there also provide the quick tips information about the cell.

iv) Animation

In this module, 3D animation processes that involve the cell were creating in the video format. The main purpose for this module is to give the clear conceptual how the process is happening in the 3D way. The processes have been cover is mitosis, meiosis, RNA synthesis transcription, protein synthesis translation and DNA replication.

v) Tutorial

Besides of providing the information, this system also set tutorial module to test user knowledge after they gain the fundamental yet basic knowledge about the cell. In this module, the tutorial is creating in the interactive format such as drag and drop format, multi-choice answer format, and others.

vi) Admin

In this module, admin can register the new admin, view and edit the record of admin. Besides that, it also can view member profile and feedback comments send by user. Tutorial question also can be add and view in this module.

4.2.2 Non-functional Requirement

In system requirement, non-functional are describes not what the system will do but it describe how the system will perform. Non-functional requirements are a description of the features, characteristics, and attributes of a system. Non-functional also constraints the services or function offered by the system such as timing constraints, development process constraints and others (Sommerville, 2004). Below are the non-functional requirements that are needed for the 3DiC system:

i) User friendly

This is the very important to make sure the user are comfortable and would not encounter any difficulties during using this system. So, the overall of system should be ease to use, learn, understand, use and assist the user whenever needed. For example, the link button at the same position for each page, the consistency of color scheme for the interface, provides the site map and other features.

ii) Attractive interface

Attractiveness for the system is very important to introduce a system to the user. The most important part to increase the attractiveness of the system is interface of the system. The visual illustrator's graphical, audio, video and

colorful background can maintain the user's interest and attention. A reasonable amount of animation also would be implemented in this system to draw attention and dearer of the user.

iii) Easy to navigate

The navigation of the system must simple yet related, consistent and easy to recognize to suit the ability of the target user. For example, the navigation buttons and icons are at the same position in each of the interface to avoid the confusing of the user.

iv) Interactive

This feature is to let user communicate with the system. The interactive among the user and system can accomplish the learning process and user will be interest in this kind of learning process. The most common interactive for this system is clicking on the links to navigate around the system. Besides that, this system provides the real time environment such as rotate, zoom in and out, move around features for user to interact with the 3D cell.

v) Learn ability

This feature refers to what will the new and occasional user accomplish after using this system. This system is the interaction 3D multimedia learning tools, users will be able to understand faster and more effective through this brand new learning way. Besides that, users will be understand faster and use this system more effective to choose the modules that they prefer without difficulty in remember how to use and navigate after long time did not using this system.

vi) Understandable

In term of the coding method, this system coding are allow other programmers to understand the program flow so that the necessary changes for segment of the system will be easily. Meanwhile, the original program flow are remaining which would not bring any affect for the previous user.

vii) Reliability

This system is made stable on the target operating system specifications. A system is reliability if it is consistent, stable and uniform result over repeated observations under the same conditions for each time being use.

viii) Efficiency

In computer terminology, system efficiency means the process can be accessed in unlimited number of time to produce the same outcome. This feature is very importance to let user use this system in unlimited number. For example, the tutorial module can be producing the question for each request from the user.

4.2.3 Software Requirement

Software requirement is the software that suitable for developing the system. Below is the software that had been used to build the system.

i) 3D Studio Max 7.0

It is the 3D modeling, animation and rendering program. This tool is widely used in the area of interactive visual effects for game and movie. This software includes an animation module that uses inverse kinematics which link component of the object together so that they can move together adding to the effect of bringing a character to life.

ii) VRML

By using VRML, 3D virtual world can be creating. The most exciting feature of the VRML is it enables to create dynamic worlds and sensory-rich virtual environment on the Internet including animate objects, play sound and movie, allow user to interact and control and enhance worlds with script (Ames, Nadeau and Moreland, 1997).

iii) Adobe Photoshop 7.0

Photoshop is the most popular professional Digital imaging software program from Adobe. It used for the color correction, tonal adjustment, sizing, and cropping of digital image files. It is also enables you to do retouching, image manipulation, compositing, and special effects.

iv) Macromedia Dreamweaver MX

Dreamweaver is a website development program for Windows and the Macintosh from Macromedia. It is a complexity program that has many advanced features, including the "Roundtrip" capability which lets you seamlessly move back and forth and make changes in both the visual mode and HTML mode.

v) PHP

Known as Hypertext Preprocessor, is an open source server-side scripting language for web servers, which provides a real alternative to ASP, ColdFusion, Mod_Perl or JSP if your aim is to provide dynamic web pages. It allows web developers to create dynamic content that interacts with databases. PHP applications are normally found on Linux servers and in conjunction with MySQL databases (Understanding PHP, 2004).

vi) MySQL Server

Known as Structured Query Language is a standard interactive and programming language for getting information from and updating a database. It is a true multi-user, multi-threaded RDBMS (Relational Database Management System) server that uses SQL to interact with and manipulated data (Good, 2004).

vii) Apache

Apache is open-source HTTP Web server software. It is usually run on Unix operating system but it can also be run on Windows. It also designed to work with a wide range of languages, either via the CGI model, or

through the use of dynamic modules by directly incorporating the language interpreter into the Apache environment (Brown, 2003).

4.2.4 Hardware Requirement

Hardware requirement is the statement of minimum requirements need by the computer such as peripheral equipment, their capacity and time available for use. These requirements need to be set to determine the feasibility performance of the system. Below is the minimum hardware requirement for 3DiC system:

- Microsoft Windows
- Processor: Intel Pentium III or AMD, 500MHz or higher
- Random Access Memory: 256MB or higher
- Hard disk: 20Gb
- Graphics card supporting 1024 x 768 x 16-bit color with 64 Mb RAM or higher.
- Sound card and speaker
- Cabling for TCP/IP- compliant network
- Video input and output devices
- Other standard computer peripheral

4.3 Delivery Medium

Delivery medium is the medium used to present the system to reach the user. For this system, the delivery medium is the web-based. This medium has become universal and use internet and web browser technology the cost-effective way to present the information to the user. Further more, by using this medium people around the world can share the knowledge.

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Chapter 5
System Design

5.1 Introduction of System Design

System design (System design, 2006) is the design of the information processing system covering the activities of defining detailed requirements, designs of data flow, database, user interfaces, physical design and hardware and software configuration design. System design is concerned with how the system functionality is to be provided by different components of the system. Meanwhile, design defined as the process of applying techniques and principles for the purpose of defining a device, a process or a system in sufficient details to permit its physical realization.

System design had a more crucial and respect role in the data processing. With increasing of software, platforms have enhanced the discipline of software engineering at systems design's expense. Object-oriented analysis and design method are becoming the most widely used methods for system design (System design, 2006). The Unified Modeling Language (UML) has become the standard language used in Object-oriented analysis and increasingly used as modeling software and non-software systems and organization design.

System design is the creative process in which requirements are translated into representation of software and transforming the problem into a solution. System design build on the knowledge get from analysis phases and it uses the requirements to design

a system that will meet the user's needs. Meanwhile design phases is focuses both logical and physical or technical aspects of the system (Sellapan, 2000). The common system design of the proposed knowledge Management System can be viewed in the following aspects which are system architecture design, database design and user interface design.

5.1.1 Benefits of System Design

Usually, system design has been provide a several benefit as below:

i) As a guideline for the system developer to design the system.

ii) Specific sizing data is provided instead of raw material for further development.

iii) Improved system performance.

iv) Gain a detailed understanding of how their users use their system.

v) Potential to learn of future concerns, allowing taking proactive measures to avoid problem.

vi) A baseline performance level is established against which benefits can be compared and changes to the system predicted or foreseen.

5.2 System Architecture

System architecture is a description of the design and content of a computer system. If documented, it may include information such as a detailed inventory of current hardware, software and networking capabilities (IES, 2004). The description of long-range plans and priorities for future purchases, and a plan for upgrading or replacing dated equipment and software.

System architecture can be thought of as both process and a discipline to produce efficient and effective information system (McGovern, 2005). It can be a process or discipline. It is process because a set of steps is followed to produce or change the architecture of a system. Meanwhile it is a discipline because a body of knowledge informs people as to the most effective way to design. A system is an interconnected set of machines, applications, and network resources.

System architecture unified that set by imposing structure on the system. System architecture encompasses the infrastructural layer as below Figure 5.1.

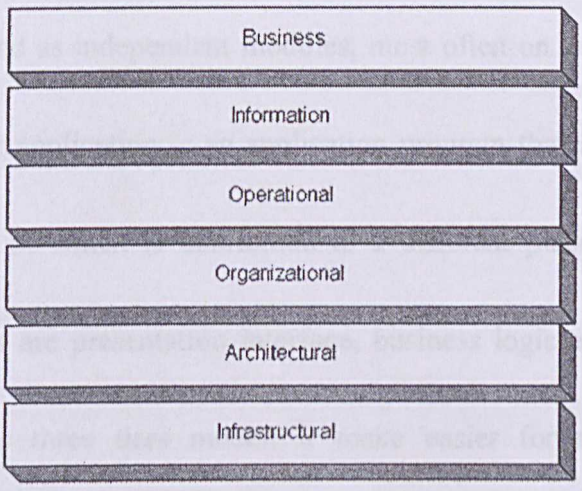

Figure 5.1: System Architecture

5.2.1 Three-tier web client-server Architecture

In 3D Interactive Multimedia Learning Tool in Biology system, three-tier web client-server architecture was being used to achieve the requirement system architecture. Below is the 3-tier architecture as figure 5.2.

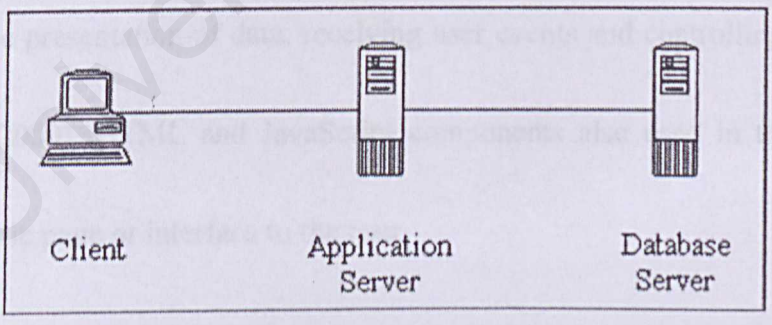

Figure 5.2: 3-tier Architecture

Generally, the 3-tier architecture also known as client-server architecture in which the user interface, functional process logic, data storage and data access are

developed and maintained as independent modules, most often on separate platforms (Three-tier, 2006). 3-tier application is an application program that is organized into three major parts, each of which is distributed to a different place or places in a network. The three parts are presentation interface, business logic and database and programming. With this three tiers model, it make easier for an enterprise to continually evolve an application as new needs and opportunities arise.

5.2.1.1 Presentation Interface-tier

Presentation interface tier also known as client-tier. In a typical application, this tier contains the programming that provides the graphical user interface and application specific entry forms or interactive windows. Presentation interface- tier is responsible for the presentation of data, receiving user events and controlling the user interface (Hage, 2000). HTML and JavaScript components also used in this tier to provide the dynamic page or interface to the user.

5.2.1.2 Business Logic-tier

Business logic is located on a local area network server (LAN) or other shared computer and it also known as application-server-tier. This tier contains classes,

objects, instance variables, vectors, primitives, methods and inheritances. The objects mostly have a temporary nature and "live" in memory for the duration of a transaction or session.

This tier also acts as the server for client request from workstations and it will determine what data is needed and acts as a client in relation to a third tier of programming that might be located on a mainframe computer. It will processes the request from the client and produce the result in the webpage format and also processes any data request of the user by linking to the database-tier which contain in the bottom tier.

This tier is protecting the data from direct access by the clients (Hage, 2000). In the non-visual area of the system, components on the server-side can be defined as configurable objects, which can be put together to form new application processes.

5.2.1.3 Database-tier

Database-tier is including the database and a program to manage read and write access to it. While the organization of an application can be more complicated than this, the 3-tier view is a convenient way to think about the parts in a large-scale program. This tier is the widespread relational database systems, existing legacy systems

databases are often reused here (Hage, 2000). The most important is this tier are quite easily possible to run all three tiers on one and the same machine, the system is neatly structured and there is well planned definition of the software boundaries between the different tiers (Hage, 2000).

5.2.2 Advantage of Client-Server Architecture

i) With the right approach, the 3-tier architecture saves development manpower. Code each bit only once, with powerful re-usage (Hage, 2000).

ii) Divide and conquer strategy. Every layer is rather easy to develop. So, is better to have 3 simple parts that one complex whole(Hage, 2000).

iii) High Quality will be produce. For each layer a specialist can contribute specific expertise, a GUI designer for the presentation interface layer, a java programmer for the business-logic layer and a database designer for the database (Hage, 2000).

iv) Clear separation of user-interface-control and data presentation from application-logic. Through this separation more clients are able to have access to a wide variety of server applications. The two main advantages for client-applications are clear: quicker development through the reuse of

pre-built business-logic components and a shorter test phase, because the server-components have already been tested (d-tec, 1998).

v) Business-objects and data storage should be brought as close together as possible, ideally they should be together physically on the same server. This way - especially with complex accesses - network load is eliminated. The client only receives the results of a calculation - through the business-object, of course (d-tec, 1998).

vi) In contrast to the 2-tier model, where only data is accessible to the public business-objects can place application-logic. As an example, an inventory number has a "test-digit", and the calculation of that digit can be made available on the server (d-tec, 1998).

vii) As a rule servers are "trusted" systems. Their authorization is simpler than that of thousands of "untrusted" client-PCs. Data protection and security is simpler to obtain. Therefore it makes sense to run critical business processes that work with security sensitive data, on the server (d-tec, 1998).

viii) Dynamic load balancing: if bottlenecks in terms of performance occur, the server process can be moved to other servers at runtime (d-tec, 1998).

5.3 Database Design

Database design is the process of planning and organizing the content and structure of a database that will meet a user's requirements which contains all the needed logical and physical design choices and physical storage parameters needed to generate a design in data definition language, which can then used to create a database. [10] The activity was including three separate but dependent steps which are conceptual database design, logical database design and physical database (Database design, 2006).

The database used in this system 3DiC is a relational database model. Data dictionary or metadata is the description of the database structure and contents. Data dictionary defines the field, field type and descriptions of each table and it identify processes where the data are used and where immediate access to the information in database needed. Data dictionary entries should contain specific categories or information including:

i) Name and aliases of the data item

ii) Description of the data item

iii) Data elements related to the entry

iv) Permissible range of the data item

v) Its allowable length in characters

vi) Any other pertinent editing information.

Below are the tables, which used in the database development of 3DiC:

Field Name	Data Type	Length	Description	Primary key
id	int	3	Auto increment ID	Yes
firstname	varchar	20	Admin's first name	No
lastname	varchar	20	Admin's last name	No
username	varchar	10	Admin's login ID	No
password	varchar	10	Admin's login password	No
address	varchar	200	Admin's address	No
phone	varchar	15	Admin's phone number	No
email	varchar	20	Admin's email address	No

Table 5.1: Table of Administrator

Field Name	Data Type	Length	Description	Primary key
id	int	3	Auto increment ID	Yes
name	varchar	50	User's name	No
comment	text		Comment for the website	No

Table 5.2: Table of Feedback

Field Name	Data Type	Length	Description	Primary key
id	int	3	Auto increment ID	Yes
firstname	varchar	20	User's first name	No
lastname	varchar	20	User's last name	No
username	varchar	20	User's login username	No
password	varchar	10	User's login password	No
address	varchar	200	User's address	No
phone	varchar	150	User's contact number	No
email	varchar	20	User's email address	No

Table 5.3: Table of User

Field Name	Data Type	Length	Description	Primary key
id	int	3	Auto increment ID	Yes
question	text		Tutorial question	No
answer1	varchar	255	Answer option A	No
answer2	varchar	255	Answer option B	No
answer3	varchar	255	Answer option C	No
answer4	varchar	255	Answer option D	No
answer	varchar	255	The correct answer	No
explain	varchar	255	Explanation for the answer	No

Table 5.4: Table of Tutorial

5.3.1 Entity Relationship Diagram

Entity-relationship Diagram (ERD) also known as entity-relationship model. It is a graphical representation of entities and their relationship to each other. Usually is used in computing in regard to the organization of data within databases or information

systems. An entity is a piece of data or an object or concept about which data is stored. A relationship is how the data shared between entities.

There are three types of relationship between entities which is:

i) One to One

One instance of an entity (A) is associated with one other instance of another entity (B) (ER Diagram, 2006).

ii) One to Many

One instance of an entity (A) is associated with zero, one or many instances of another entity (B), but for one instance of entity B there is only one instance of entity A(ER Diagram, 2006).

iii) Many to Many

One instance of entity (A) is associated with one, zero or many instances of another entity (B), and one instance of entity B is associated with one, zero or many instances of entity A (ER Diagram, 2006).

Below is 3DiC system ER Diagram:

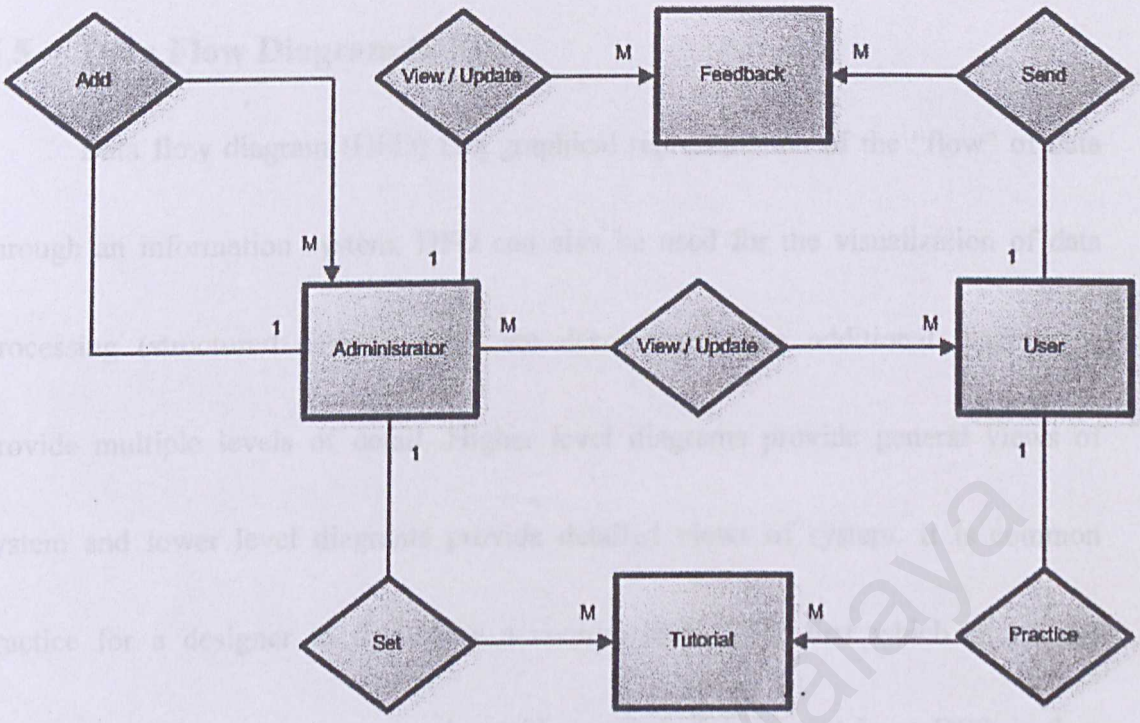

Figure5.3: Entity- relationship Diagram

5.4 Context Diagram

A data flow diagram of the scope of an organizational system that shows the system boundaries, external entities that interact with the system and the major information flows between the entities and the system.

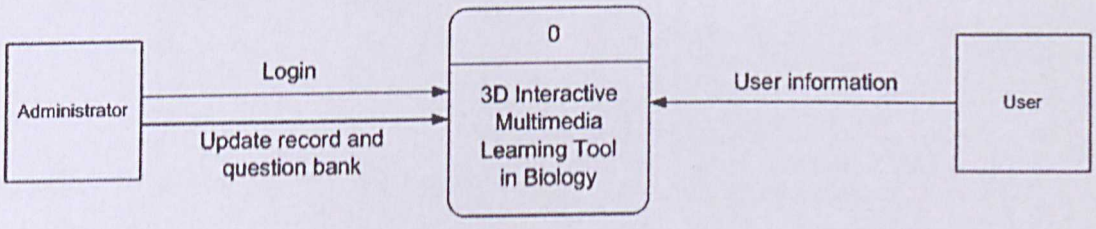

Figure 5.4: Context Diagram

5.5 Data Flow Diagram (DFD)

Data flow diagram (DFD) is a graphical representation of the "flow" of data through an information system. DFD can also be used for the visualization of data processing (structured design). DFD are decomposed into additional diagram to provide multiple levels of detail. Higher level diagrams provide general views of system and lower level diagrams provide detailed views of system. It is common practice for a designer to first draw a context level DFD first which shows the interaction between the system and outside entities, this context level DFD is then "exploded" to show more detail of the system being modeled (DFD, 2006).

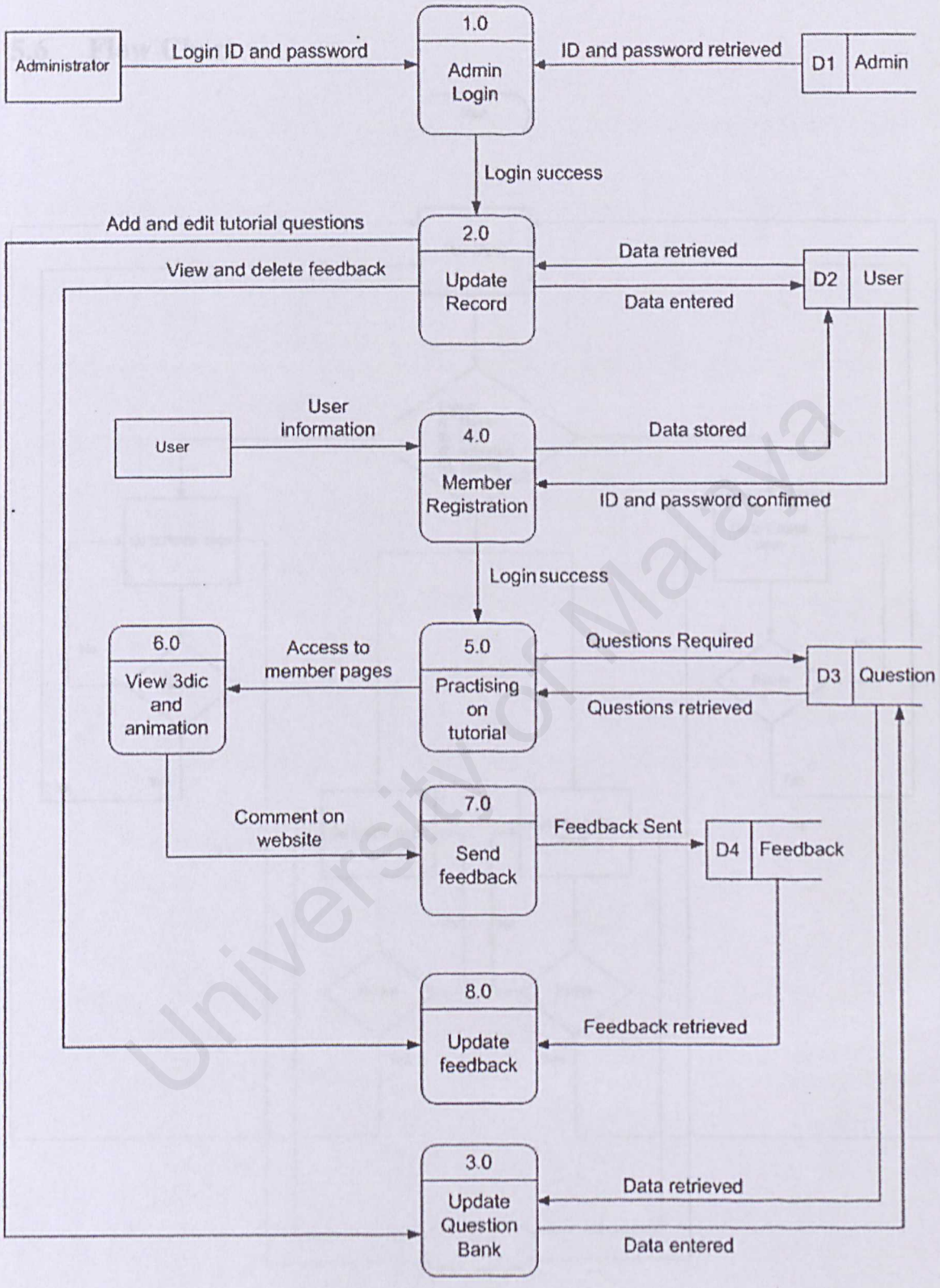

Figure 5.5: DFD of 3DiC

5.6 Flow Chart

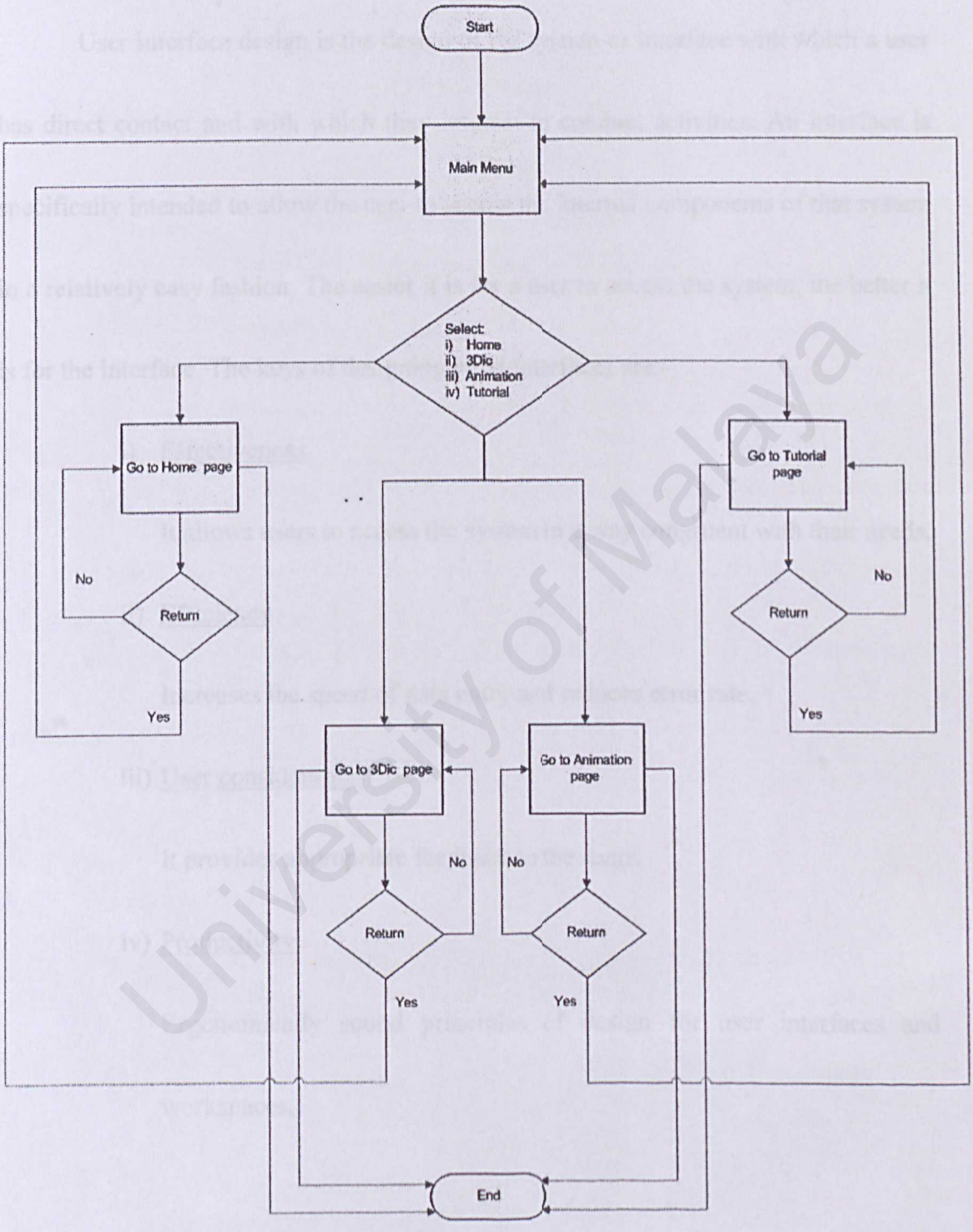

Figure 5.6: Flow Chart of 3DiC

5.7 User Interface Design

User Interface design is the design of the system or interface with which a user has direct contact and with which they interact to conduct activities. An interface is specifically intended to allow the user to access the internal components of that system in a relatively easy fashion. The easier it is for a user to access the system, the better it is for the interface. The keys of designing good interfaces are:-

i) Effectiveness

It allows users to access the system in a way congruent with their needs.

ii) Efficiency

Increases the speed of data entry and reduces error rate.

iii) User consideration

It provides appropriate feedback to the users.

iv) Productivity

Ergonomically sound principles of design for user interfaces and workspaces.

5.7.1 3DiC Index Page

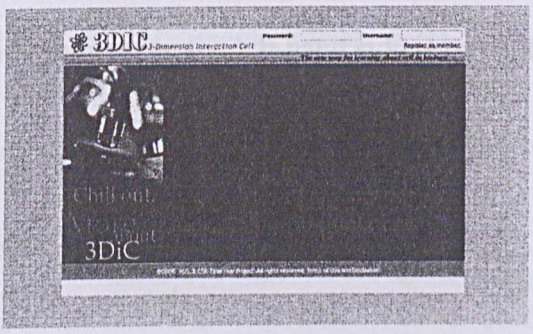

Figure 5.7: Home interface for prototyping

This is the index page interface once the website has been visited. For security and copyright purpose, this system required users to register as a member. Besides that, this page also provides the link to other module. Meanwhile the authority administrator also require to log in their user name and password if their want to update the information or question.

5.7.2 About Us Page

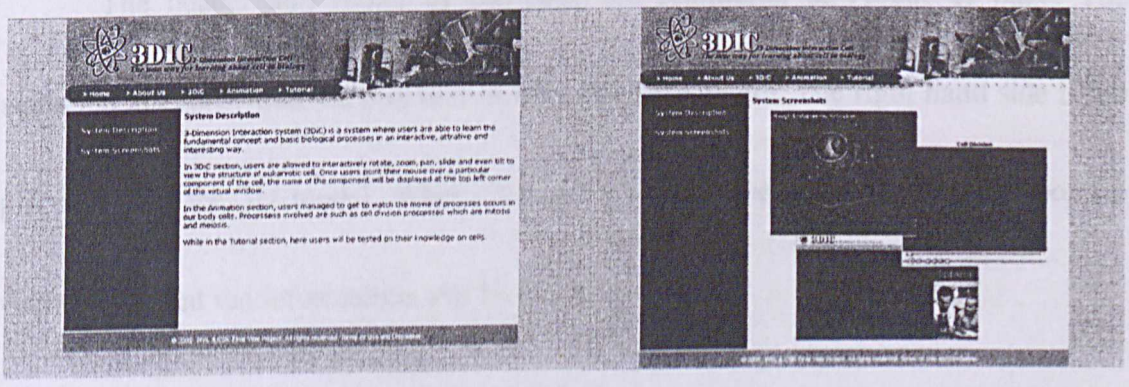

Figure 5.8: About us interface for prototyping

At About us page, the header are provide the main link which can link to other module. Meanwhile, the submenu on the left hand side is providing the link for link the sub-page under category in About us page. The footer at the bottom are provide the email link to the developer.

5.7.3 3DiC Page

Figure 5.9: 3DiC interface for prototyping

The header and footer of the page are reminding as About us page. The submenu also provided the link that link to other 3D model. The right hand side is the place display the 3D model. When click on the components of the cell, the pop up window content the information will be displayed.

5.7.4 Animation Page

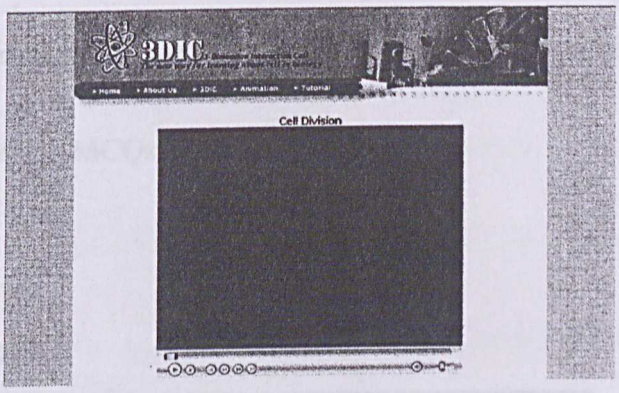

Figure 5.10: Animation interface for prototyping

In animation page, the system, the header and footer of the page are reminding as the rest of the page. The submenu also provided the link that link to other 3D animation video.

5.7.5 Tutorial Page

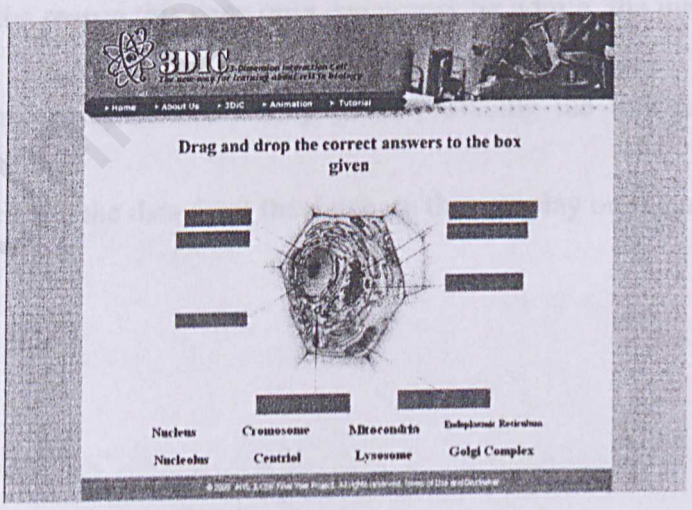

Figure 5.11: Tutorial interface for prototyping

In this page, the header and footer of the page are reminding as the rest of the page. The submenu also provided the link that link to other tutorial section such as drag & drop, puzzle and MCQs.

5.7.6 Admin Page

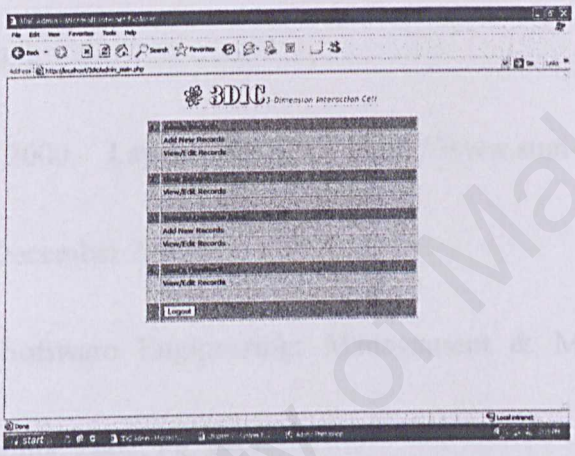

Figure 5.12: Admin interface for prototyping

Due for the reason this page only can access by admin, the interface design are designed as simple as possible. This page is providing the link to connect to the database and retrieved the data from the database then display on the interface.

5.8 References

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Chapter 6
System Implementation

6.1 Introduction of System Implementation

System implementation is the process of converting the system from the planning phase to operational mode. In the other word, system implementation is the process converts the system requirements and designs into workable program. In the system implementation, it involved the process of determine the software and hardware that to be used, the specification that will be used to develop the whole system and also involves some modifications to the previous designs in to program codes. Simultaneously, testing and debugging also is carried out. System testing verifies that a system solves the problem as defined by requirements documents.

6.2 Development Environment

Development environment was giving a very huge effect on the development of a system. Choosing the suitable hardware and software for the development is very important which can affect the speed of the development progress. Besides of that, it also determines the successful of the project because unsuitable hardware and software will affect the performance of the whole system. In this chapter, the process of setting up the application for implementation and also the tools have been used to develop the system will be discussed.

6.2.1 Hardware Used for System Development

The hardware requirements used for developing 3DiC system are:

- Pentium 4, 2.66GHz
- 512 MB RAM
- 16X DVD-ROM Drive
- USB Flash Drive 256 MB
- 80 GB Hard Disk
- Sound Blaster Compatible Sound Card
- Display Adapter
- Cabling for TCP/IP- compliant network
- Graphics card supporting 1024 x 768 x 16-bit color with 64 Mb RAM or higher.
- Others standard desktop PC accessories such as Keyboard, mouse, monitor speaker and etc.

6.2.2 Software Used for System Development

Software tools are plays a vital role in determining the usability of the system. The vast array of software have been used to develop the 3DiC system are briefly described in Table 6.1.

Software	Module	Description
Windows XP	System requirement	Operating system
Microsoft Internet Explorer 6.0/ Netscape Communicator 4.7	System requirement	Website and VRML file viewing
3D Studio Max 7	System development	3D Modeling, texturing, animating and rendering
Adobe Photoshop 7.0	System development	Image editing and website designing
Sound Forge 7.0	System development	Audio recording and editing
Macromedia Flash MX	System development	Produce 2D interactive tutorials
Macromedia Dreamweaver MX	System development	Website developing and editing
VRML 2.1	System development	VRML code editing
Cosmo Player 2.1.1	System Requirement	VRML file viewing
AppServ	System development	PHP coding
Ulead Video Studio 7	System development	Video editing

Table 6.1: Software used for system development

6.3 System Development

During the development 3DiC system, there are involve three main part developments process which is:

i. Website module development

ii. 3D model and animation Module development

iii. Database module development

6.3.1 Website Module Development

The main tools used to develop the 3DiC website are Macromedia Dreamweaver MX and also Adobe Photoshop CS. First of all, the designing was doing in Adobe Photoshop CS, then export to the HTML format. Then, using the Macromedia Dreamweaver MX to do the modification and editing. The resolution of the website set to 1024 x 780 resolutions.

6.3.2 3D model and animation Module development

In 3DiC system, there are involved the 3D component development and also 3D animation development. All this 3D element was create by using 3D Studio Max 7.0. For the 3D model, the variety of techniques such as extrusion, edit mesh, shell,

smooth mesh, bend, slice, mirror, transparent and etc have been used to develop the prokaryotic cell and eukaryotic cell model. After the finish the modeling part, each component of the model have been group together and then export to the VRML so that interactive between the user and model can be achieve.

For the 3D animation part, component "camera" was playing an important part to provide the good shot for the video. The camera is moving step by step according to the time. Every action length is in control so that it can come out an effect as guide as for the each cell animation process. Then, the movies were rendering using 3D Studio MAX with 640 x 480 resolutions and in 100% quality. The output for the rendering is in the AVI file format. AVI format is a movie playback format where models are first animated within 3D MAX before it is render and export to this format. Movie that have been export in the AVI file format consume large amount of storage space because each and every timeframe will be rendered and stored sequentially. Duel to this large amount of storage reason, Ulead video compositing have been used to convert the movie in the AVI file format to the WMV file format which consume more small size. Besides that, the text and explanations audio for each animation also have been added to the movie by using Ulead video compositing. The audio is record and edit by using Sound Forge 7.0 and then export to the WMA file format. WMA file format is been

chosen is because this file consume the smaller size if compare with other audio file format.

6.3.3 Database Module Development

3DiC system is the website that only can access by the users who already register as the member. All these information have been add into the database where control by the admin. Database for 3DiC is developed by using MY SQL and also control by PHP. In this database, it contents four table which:

i) Admin table

Store the admin information which consist several field such as id, firstname, lastname, username, password, address, phone and email.

ii) User Table

Store all the register user information where consist several field which same as admin.

iii) Feedback table

Store the feedback information that has been send by the members. This table consist id, name and comment field only.

iv) Question Table

Store the entire question that will be use in the tutorial. This table consist id, question, answer1, answer2, answer3, answer4, answer and explain.

6.4 Interface Implementation

3DiC system's interface is designed and developed using Adobe Photoshop CS and Macromedia Dreamweaver MX. 3DiC system interface have been divided into 5 modules which is Home, About Us, 3DiC, Animation, Tutorial and Admin.

6.4.1 Home Interface

Home is the main page that link to other page. This page is the only page that can let the user register or member to sign in. Figure 6.1 shown Home page interface in 3DiC system. At this page, register link are provide to let user to sign up as a member so that they can access the other module. Figure 6.2 shown a register page.

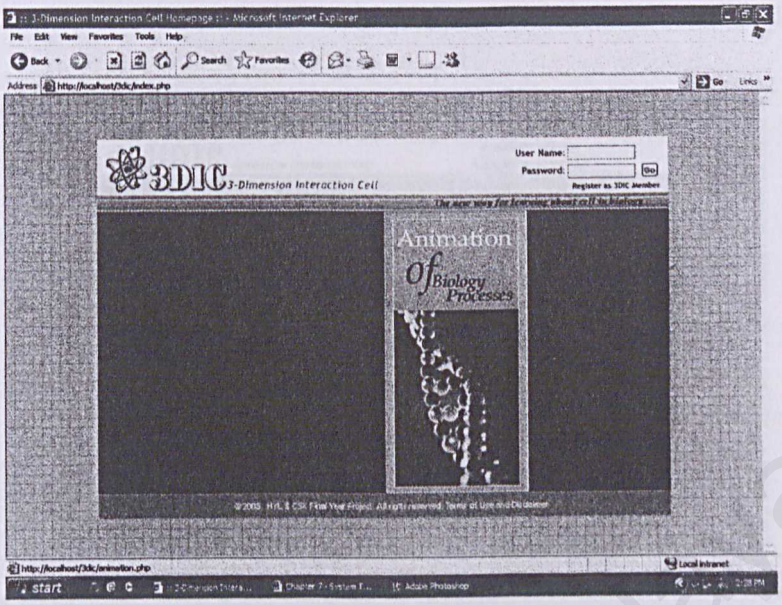

Figure 6.1: Home page of 3DiC

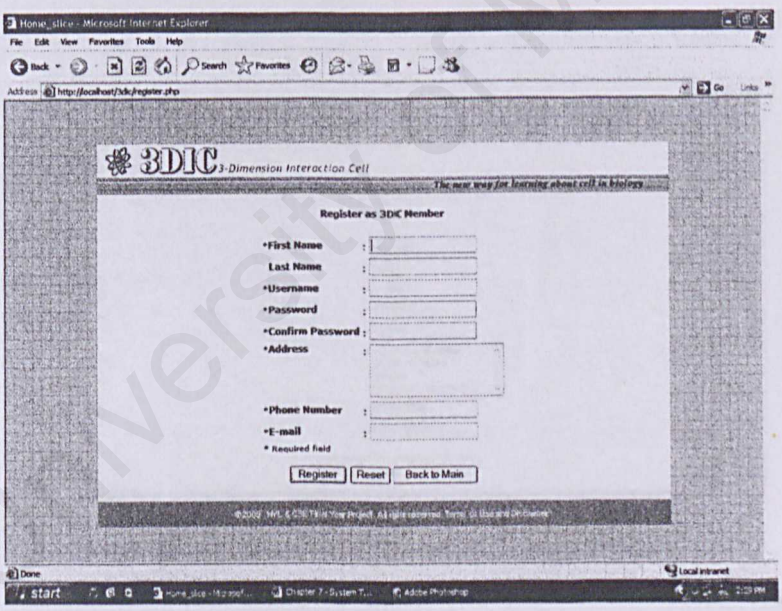

Figure 6.2: Register page for 3DiC

Figure 6.2 shown the Home page interface one the user login to the website.

The button "Edit Profile" allow user to edit and save their latest data. The interface are shown as figure 6.4.

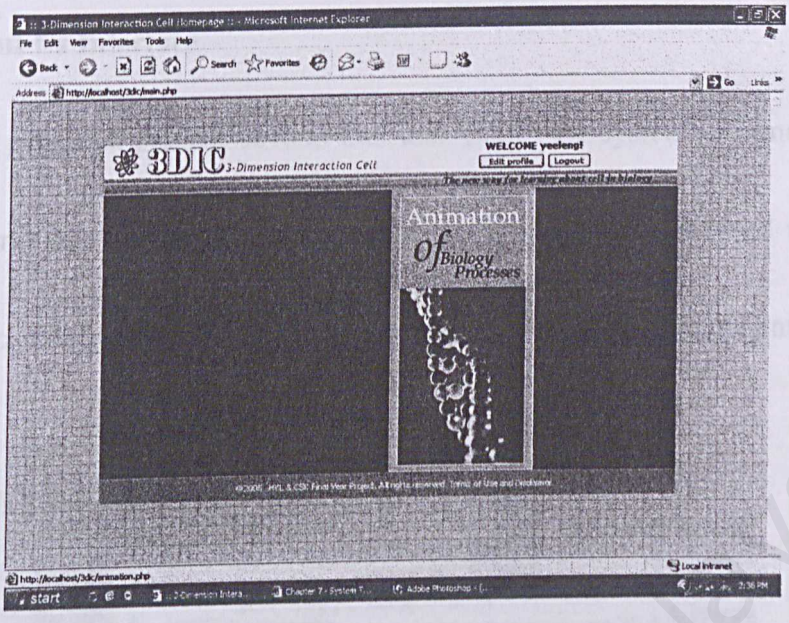

Figure 6.3: Home page of 3DiC after login

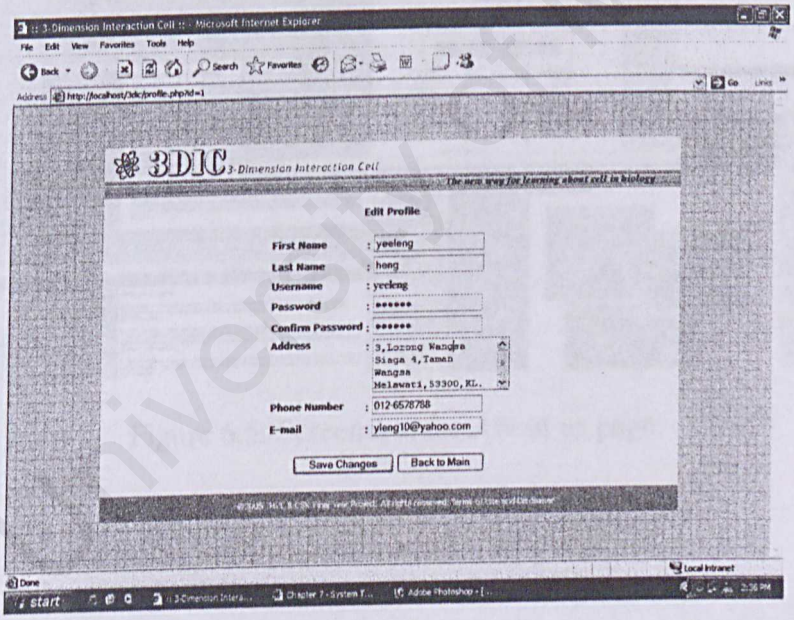

Figure 6.4: Edit profile page

6.4.2 About Us Interface

This page that provide several link that link to the system information such as system description, system screenshot, downloads, site map, FAQ and the feedback page which can only access by member. Figure 6.5 is the entire component in About us page.

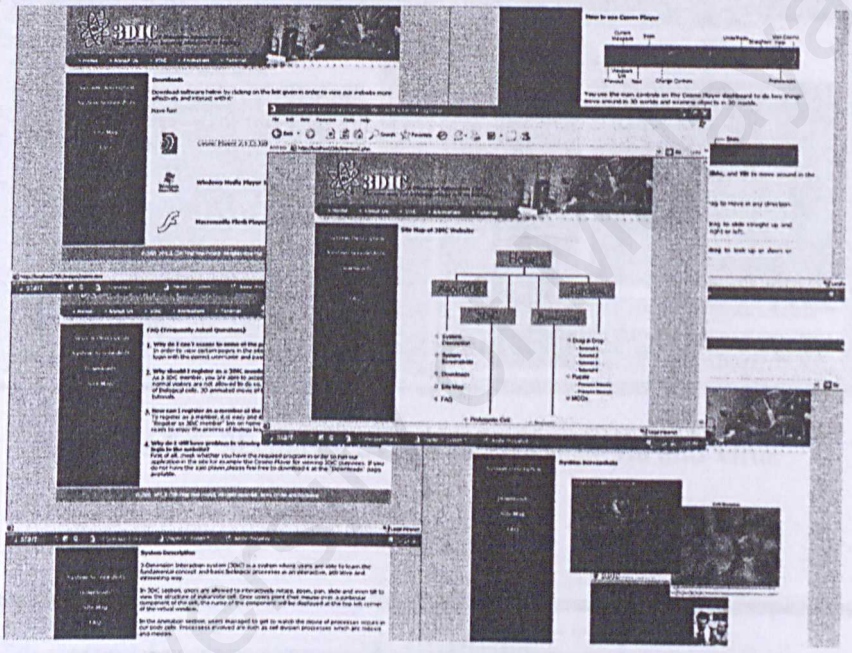

Figure 6.5: Screenshot for About us page.

6.4.3 3-Dimension Interactive Cell Interface

This page is the page that content 3D interactive cell for bacteria, virus, animal and plant. Beside that, there also got quick tips information for the user to learn more.

Figure 6.6 and 6.7 shown the 3D interactive model interface in 3DiC system.

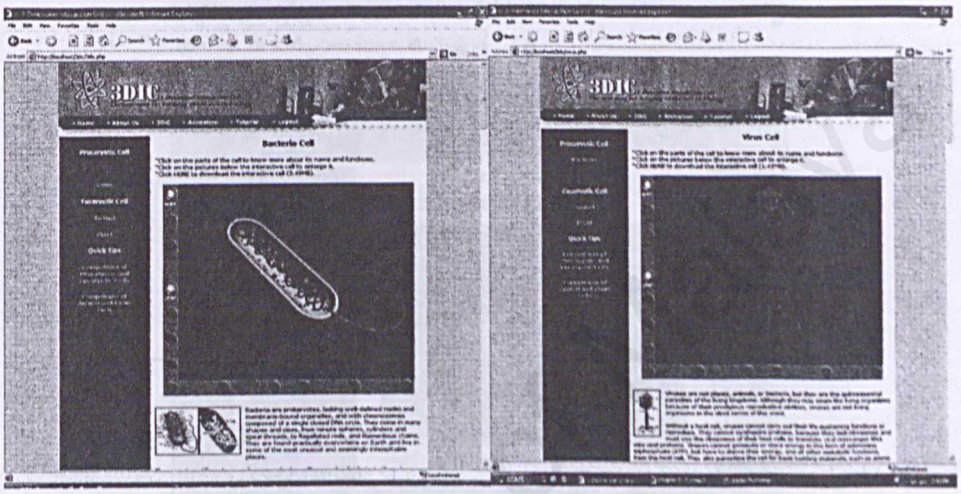

Figure 6.6: 3D interactive model for bacteria and virus

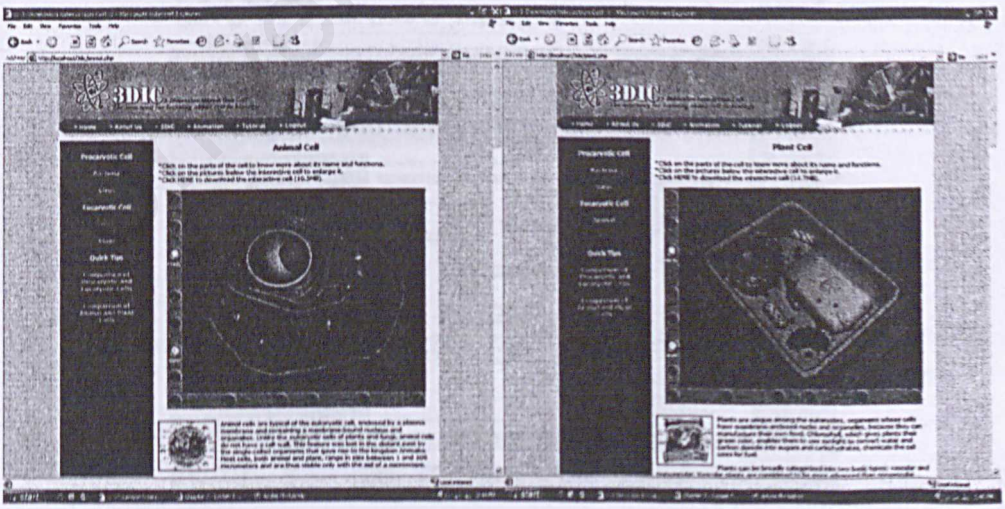

Figure 6.7: 3D interactive model for animal and plant cell

6.3.4 Animation Interface

Animation page consist five video which is mitosis process, meiosis process, DNA replication process, RNA transcription and protein translation. This page also provides the comparison for mitosis and meiosis process information.

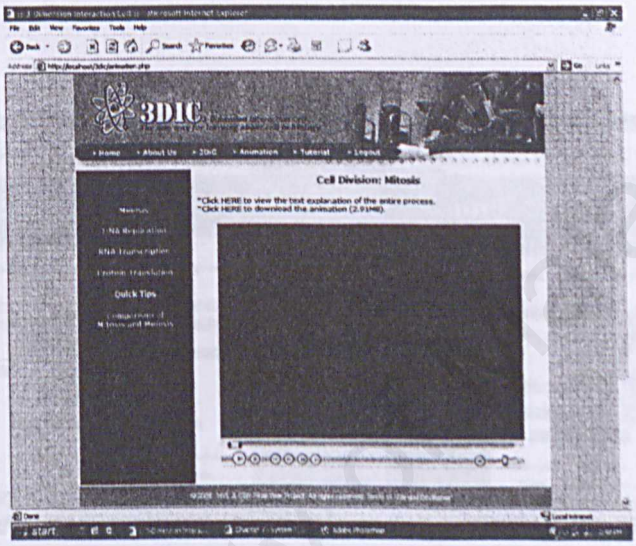

Figure 6.8: Video player interface in animation module

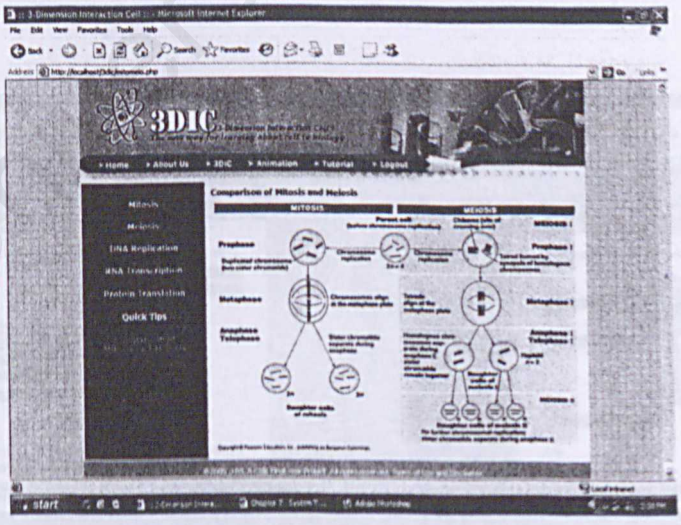

Figure 6.9: Quick tips information in animation module

6.3.5 Tutorial Interface

This page contains three main the session which are Drag&Drop, Puzzle and MCQs to let user do the practical and exercise for what they have learned through 3DiC website.

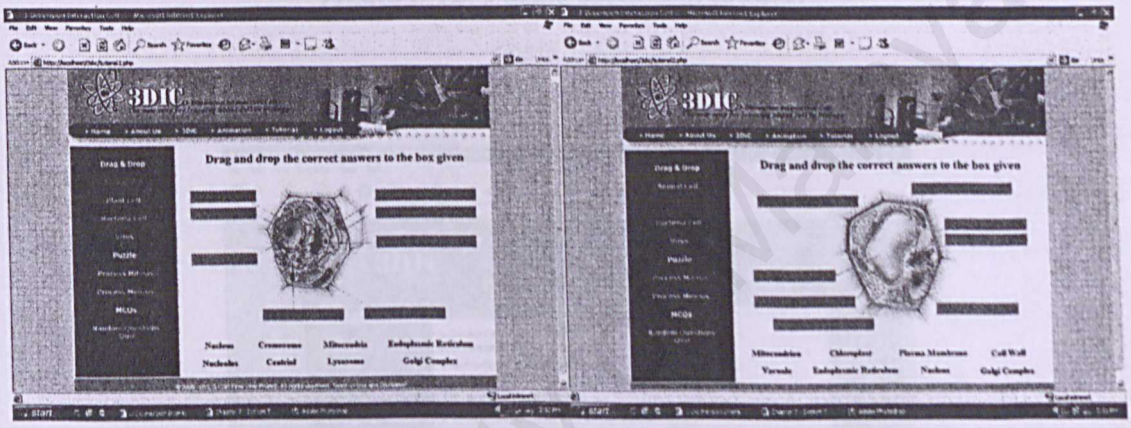

Figure 6.10: Drag&Drop tutorial for animal and plant cell

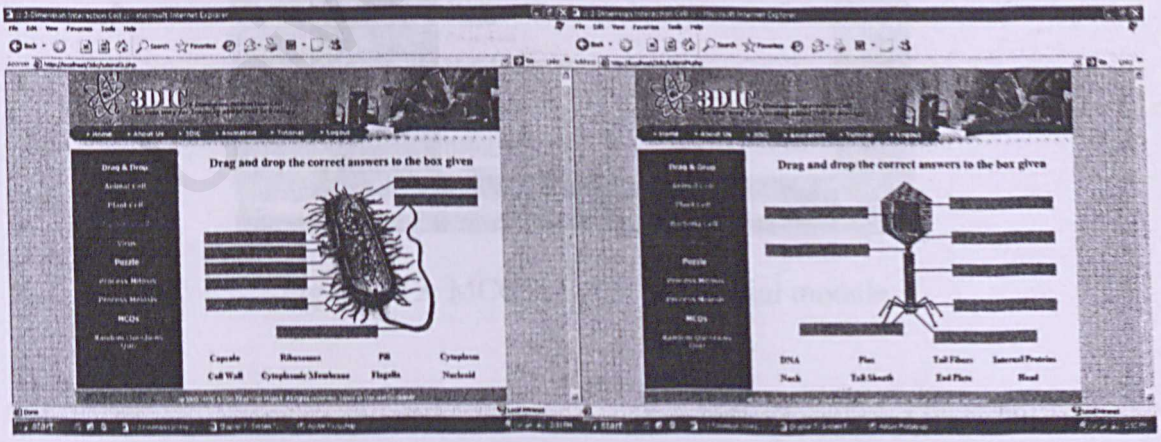

Figure 6.11: Drag&Drop tutorial for bacteria and virus

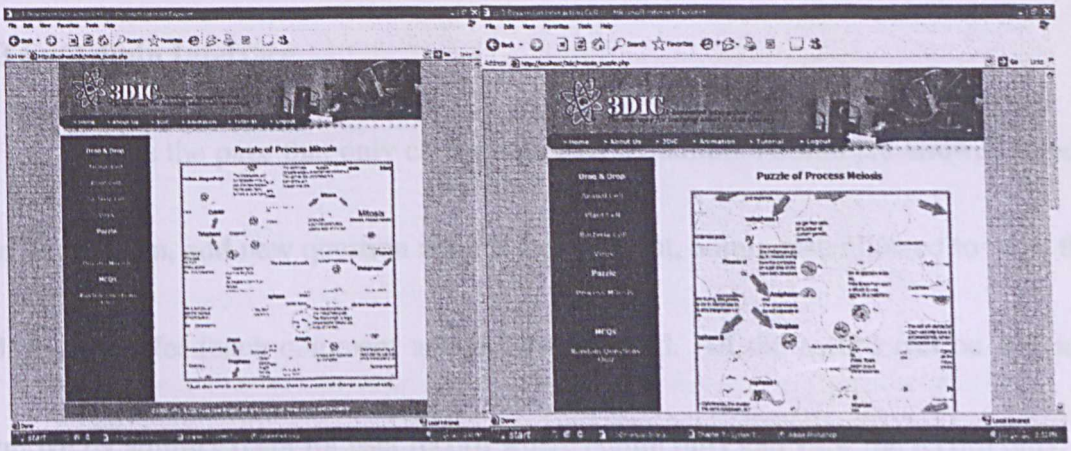

Figure 6.12: Puzzle section in tutorial

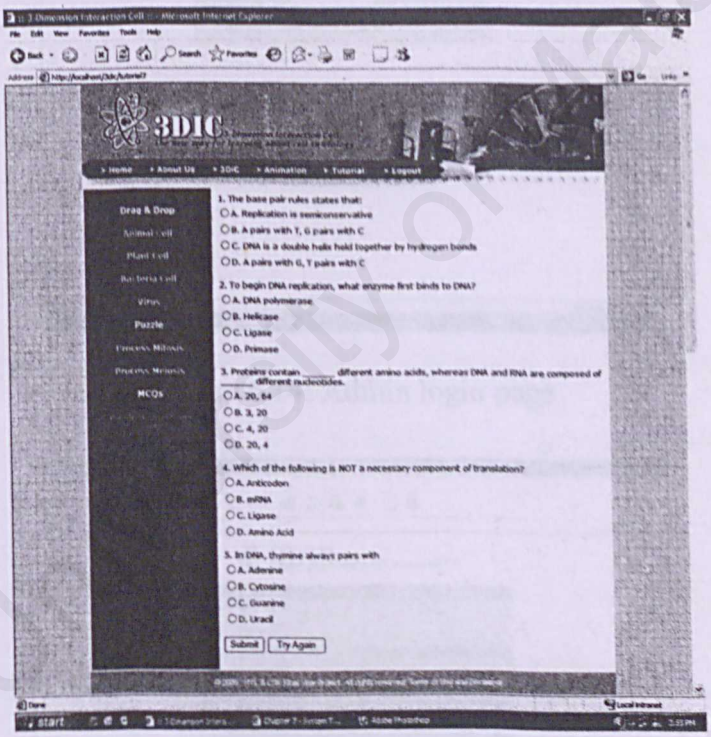

Figure 6.13: MCQs section in Tutorial module

6.3.6 Admin Interface

This is the page that only can be accessed by admin. Admin are allowed to add the new admin, add new question record. Besides that, admin also allowed to view the admin, user, feedback comment and question record. All the record can be edit and remove by admin except for user record where admin only can view the record only.

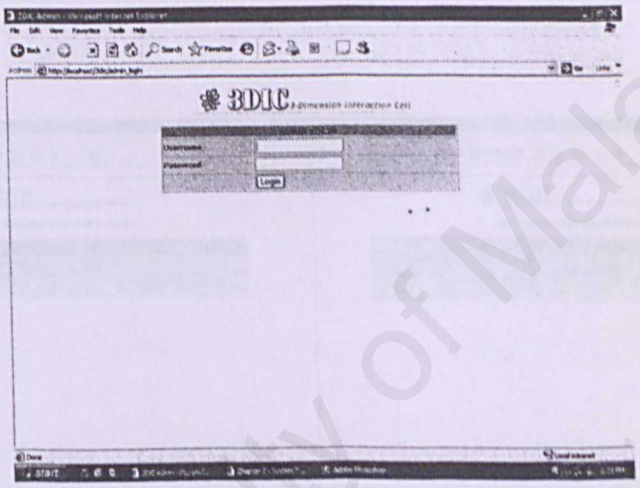

Figure 6.14: Admin login page

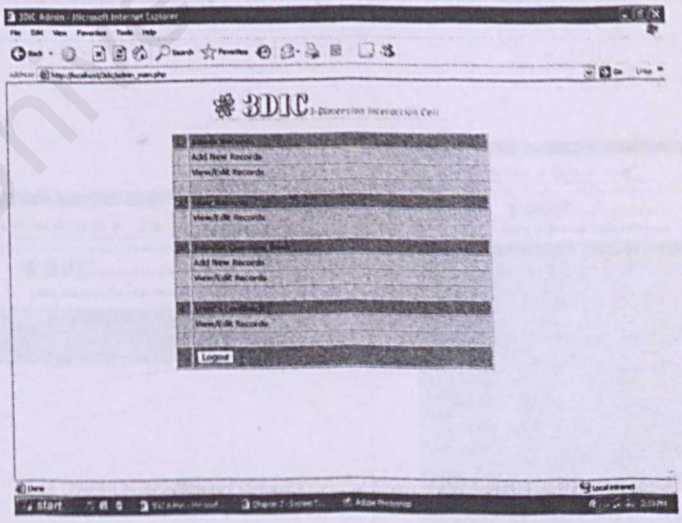

Figure 6.15: Main page after admin login

6.5 Program Coding

Coding is the process that converts a detail design representation of software in to programming language realization. Below is coding principles were applied during the implementation.

i. Coding conventions

Coding conventions such as program labeling, naming conventions, comments and indentation should be adhered too.

ii. Readability

The codes should be easy to understand, adherence to coding conventions such as naming conventions and intention contribute to program read ability.

iii. Maintainability

The codes should be easily revised or corrected. To facilitate maintenance, code should be readable, modular and as general as possible.

3DiC system coding can be divided into three parts which is website coding, 3D coding and Database & PHP coding. All the example coding can be refer at the appendix A.

6.6 References of Chapter 6

1. Sommmerville, Ian. (2004). *Software Engineering*. 7th edn. United States of America: Addison-Wesley.

Chapter 7
System Testing

7.1 Introduction of Testing Process

Testing is the verification and validation process. Verification is refers as a set of the activities that ensure the system have implementing the correct specific function. Meanwhile, validation is refers as the different set of activities that ensuring the system that have been develop is meet the user requirements.

The main objective of testing is to discover the defects from the system from the early stage and interface problem when the system is integrated. Due to the errors that have been done during the system development and design stage or during the components are integrated to make up the system, failures might be happen even thought the entire system has been developed. Therefore, the more suitable approach must be chosen to reduce the possibility of errors in a program.

Bottom-up approach is been using in system testing for 3DiC. Each module at the lowest level of the system hierarchy is been tested individually first. Then, all the tested modules would be related to the next module testing. This approach is repeated until all the modules are tested successfully.

7.2 The process of testing

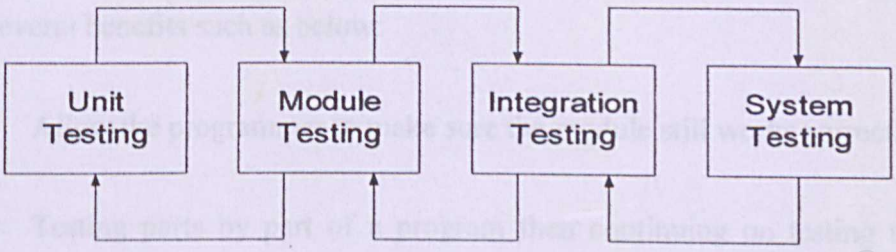

Figure 7.1: Testing Process of 3DiC

Testing only is successful when a fault is discovered or failure occurs as result of testing procedures. Figure 7.1 shows that the testing process approaches that have been used by 3DiC. Each testing is repeated before further on for the next testing.

7.2.1 Unit Testing

Unit testing is the small unit in the testing process that aims at the verification of the smallest. It is the process used to test the individual component to make sure they are function correctly. Each component is been tested individually without the interference of other component. The technique have been used during this process are code review. Codes are reviewed through line by line to identify any run-time error or syntax error. Once discovered the error, they are corrected immediately. For example, during developed 3DiC website, each page of the website has been creating separately

to ensure the position of the information and the action of the page is correct. Besides that, PHP coding also did part by part to avoid the confusing. Therefore, unit testing bring a several benefits such as below:

- Allow the programmer to make sure the module still works correctly.
- Testing parts by part of a program then continuing on testing the entire system can simplified the integration testing.
- To determine how to use the module to fit the user needs and gain a basic understanding.

7.2.2 Module Testing

Module consists of a collection of dependent components to perform a certain task or function. Module testing also same as unit testing, only performed individual module testing without interference of other system module. Different possible test cases are applied to the module and the test results would be verified. Unusual results will be analyzed and they would help in debugging sub-modules in order to produce the desired output.

3DiC consists five module, and inside each module a several component such as 3D part or database part. Therefore, module testing was tested when combining one component to the other existing part.

7.2.3 Integration Testing

After the module testing, all module were combined together to form a complete system. Integration testing is the initial system testing activity where used to tested integrated component for defects. Besides that, it also ensures the validation linking and dynamic relationship establishments between modules at the whole system and between sub-modules contained in all individual modules. Several important aspects are checked to ensure that the flow of the data in 3DiC is well organized and are user friendly to all the system users.

7.2.4 System Testing

Sub-system are integrated together to develop the completed system. System testing that attempts to discover defects to ensure that entire system rather than of its individual components is validation where it must be combined with other system element such as hardware, end user and database. This is important because the defects

might be occur during the combining where will bring the failure or fault to the whole system. System testing are also including the test on the performance, reliability, accuracy and others criteria. Besides that, it also concerned whether the system is meets its functional and non-functional requirements. Normally, tester that were involved in this testing is no the developer.

7.3 Performance Testing & Acceptance Testing

Performance testing is the performed to compare the integrated modules with the non-functional system requirements. These requirements include security, interoperability, flexibility and reliability. The purpose of this testing is to test the run time performance of this system within the context of an integrated system. Acceptance testing is the final stage of the testing process before the system is accepted for operational use. Acceptance testing may reveal errors and omissions in the system requirements definition because of the different type of data is been used for the testing. Besides that, this testing may also reveal requirements problem where the system's facilities do not really meet the user's needs or the system performance is unacceptable.

7.4 References of Chapter 7

1. System testing, Wikipedia® is a registered trademark of the Wikimedia Foundation, Inc., 2 April 2006, http://en.wikipedia.org/wiki/System_testing.

2. Sommmerville, Ian. (2004). *Software Engineering*. 7th edn. United States of America: Addison-Wesley.

Chapter 8
System Evaluation
&
Conclusion

8.1 Introduction of System Evaluation

The journey of developing the system, several problems in the hardware, software, interfaces and logic errors in programming field were encountered and most of the problem has been solved at the end. Besides that, system strengths and limitations were also evaluated by lot of users. Evaluation is the ultimate phase of developing a system which is was related to user attitudes, information priorities, environment and several other concerns that are to be considered carefully before effectiveness can be concluded. Therefore evaluation is an important phase that occurs continuously before delivery the system to the end users. Improvement of the present system and potential enhancement are based on the suggestion and evaluations result from the users.

8.2 Problems Encounter and Alternative Solution

8.2.1 Development Tools

There are many tools were available in the market to develop 3D, website and also database such as 3D Studio MAX, MAYA, LightWave, Macromedia Flash MX, Macromedia Director MX, ASP.NET, Visual Basic, ORACLE and etc. Therefore, the

large range of tools available had raised the problem for choosing the right development tools become critical process in the software development cycle.

In order to make sure the suitable tools are chosen to develop the 3DiC system, the needs of the system have been defined to narrow down the scope of the tools which will be used for develop the system. Then, research based on the type of software needed that listed before via surf internet and also the book available at library. Besides that, seeking the advices from the experiences people to ensure the tools have been choose is suitable for development 3DiC system.

8.2.2 Hardware Requirement

During the starting point, I have encountered computer cannot really support 3D application problem. Each time running the 3D application, the computer will take lot of time start the program and whole computer operation became slower. Later, I found that my computer always restart when I was open the 3D application. Due to the concept of 3D modeling and animation required a lot of patience and a high performance machine, I have upgraded my computer by adding a new graphic card and RAM to ensure my computer can support the application. The new exposure of the

new technologies of product and upcoming operating system has increased the learning curve before start the development of the system.

8.2.3 Lack of Knowledge in Software Application

3D Studio MAX software is the software I seldom been used in my study and I found it is difficult for me during the modeling phase. To avoid wasting the time, I was seeking my friend who has experience in this field to teach me a basic knowledge for using this software. Surfing on internet and book references becomes my second solution to gain for more information and techniques which can help me to mastering the concept of 3D modeling and animations techniques. Most of the confusions are resolve by study the tutorial from book references and the online tutorial.

VRML coding is been used to develop the interactive environment for 3DiC system. Many errors occurred during the programming process and I spent lot of time to do the debugging. The error been solve by referring VRML references book, online tutorial and get the assistance from friends and course mates.

Besides that, I also often encounter cannot access 3DiC webpage and 3DiC database for view 3DiC system due to localhost path and Apache Server have been interrupt with other software such as Visual Basic and ASP.NET. However, this

problem finally has been resolve by stop the IIS operation and start the Apache Server and MySQL before the access the system.

8.2.4 Limited of Completion Time

3D modeling and animation is the part that taken a lot of time for develops 3DiC system. This is because progress of 3D modeling and animating needs a big efforts, patient and amount of time to complete it. I spend quite a lot time to do the modeling during the started developed the 3DiC due to the reason of I still naive to use the tools. Further more, I spend a lot of time to do the research in library, surfing the internet and seek for people to learn the tools need to be used for development 3DiC system.

Besides of 3D modeling, a lot of time also had been spending during looking the information that is relevant with 3DiC system via internet, library and also the school syllabus for SPM. Fortunately, the entire task is been completed in time based on the timetable have been set. Therefore, a well organized timetable is very important to guide and be a reminder to remind the target task need to complete every week.

8.3 System Evaluation

3DiC is the system is the interactive 3D multimedia learning tools for biology with the main purpose is to provide the new way for learning. The final stage of system development which is the system testing becomes critical and it needs feedbacks from all respective users in judging the correctness of these functionalities, precise data flow as well as user friendliness of the system's interfaces.

The scope of 3DiC is quite large and development was conducted with the objective to cover the scope briefly and the system was not refined to show its full efficiency. The overall feedback from the end users is good and 3DiC expected to serve the targeted group well after refining.

8.3.1 System Strength

3DiC system has several strengths as below:

i) User Friendliness

This system is an interactive learning application for cell topic. Each module interface is navigated in the consistent and easy way to avoid user get lost. Site map also provided to provide the guides to let the user know the structure of website.

ii) Web-based Learning Tools

3DiC is the web-based learning tools which can be accessed by anyone. By using web-based, any user can access this system at anytime and anywhere as long as they have the computer with the network connection.

iii) Multimedia Interactive Learning Style

Multimedia elements were emphasized in 3DiC system. Thus, the content of the system are presented by using multimedia elements such as 3D interactive environment, 3D animations, speech, images, text and also video which provide the interactive way for user to gain the knowledge.

iv) Future Integration and Support High Volume of Users

3DiC is developed by using PHP which enable better integrity in the future. Beside that, 3DiC is deployed by using MySQL database which can cope with the large amount of user in the future.

8.3.2 System Constraint

Every system has its limitation, below is the several limitation of 3DiC system:

i) Limited Learning Information

Information provided in 3DiC system is limited because this system only focuses on cell topic which only covers one of the topics in the SPM biology syllabus. Therefore, user can only learning this topic through 3DiC website.

ii) Web-based Application

Web-based system has brought the two side effects for 3DiC system. Web-based system required network connection to access the system. This brings the inconvenient for those users who do not have the network connection.

iii) Multimedia element is to consume large storage

3D model and animation are consuming a large storage in the website. Therefore, it takes a long time for buffering to load the page that content 3D model and animation.

8.4 Future enhancement

As mentioned before, 3DiC is still not fine enough to work at its full efficiency. Some refining work needs to be done to the system to increase its usability and reliability. The aspects to be refine and some suggestions to upgrade the system are as below:

i) Strict data type checking

User input check strictly by using PHP to maintain the consistency of data stored and avoid error encounter.

ii) Static the radio button have been selected

In MCQs section, once user click submit button, the previous selected radio button are not display. This part need to be enhanced to let the user check whether they answer correctly or not.

iii) Display the score for tutorial

The system wills automatically generate the score of tutorial result for clearer view and better understanding of users' performance.

iv) More reality of 3D modeling and animation

Due to the first time develop the 3D model and animation, there still a lot of improvement need to enhance the modeling to make it more close to reality and attractive.

v) Administrator management

Tool should be added to the system to enable the administrator manage the site well.

8.5 Conclusion

Development the system is not an easy task as what we thought. Start from the early stage of doing research on the existing system until the end of stage, each stage have play a important role to ensure the system that have been developed has met the end users' requirements and operate in properly. The proper selection of the software been used is very important which can simplifier the development.

3D Studio MAX has been chosen used to design the 3D element and animation as it would be more easier and time sharing if compare with direct develop the 3D element by using VRML. Further more, 3D Studio MAX enable to export into VRML file which will definitely save a lot of memory storage. However, due to the limitation time, the system only included minimum requirement. Therefore, future enhancement has been proposed to do the system enhancement. A lots of experience, knowledge have been gained and improve, meanwhile, the management and communication skill also have been polish up during the completing the system.

In conclusion, 3DiC has met its objective as a virtual Reality application for education purpose. Besides that, due to the view point above, the objective of the final project has been achieved which is to give the student undergraduate an opportunity to undergo the challenges while gain the knowledge, experience and skill.

Appendix

APPENDIX A: Program Coding

i) Popup window in VRML file

```
Anchor {
  children [
  DEF ribosome Transform {
  }
]
url "javascript:function popup(){window.open('desc/bRibosome.htm','newpage','scrollbars=1,
left=192,top=144,width=640,height=480');};popup();"
},
```

ii) Randomly Picked 5 Questions from Database

```
if($resultSelect && ($_POST['submit']!='Submit'))
{
    for($i=1;$i<=5;$i++)
        {
            $randomnumber = rand(0,21);

            {
                $_SESSION['question'][$i] = mysql_result($resultSelect, $randomnumber,'question');
                $_SESSION['answer1'][$i] = mysql_result($resultSelect, $randomnumber,'answer1');
                $_SESSION['answer2'][$i] = mysql_result($resultSelect, $randomnumber,'answer2');
                $_SESSION['answer3'][$i] = mysql_result($resultSelect, $randomnumber,'answer3');
                $_SESSION['answer4'][$i] = mysql_result($resultSelect, $randomnumber,'answer4');
                $_SESSION['explain'][$i] = mysql_result($resultSelect, $randomnumber,'explain');
            }
        }
    }
?>

<tr><td><input name='<? echo $i ?>' type='radio'><font class='b12'>A. <? echo $_SESSION['answer1'][$i] ?></font></td>

<?
if(isset($_POST['submit']))
{
    echo "<td rowspan='4' width='50%'><font class='ol2'>";
    echo $_SESSION['explain'][$i];
    echo "</font></td></tr>";
}
?>
<tr><td><input name='<? echo $i ?>' type='radio'><font class='b12'>B. <? echo $_SESSION['answer2'][$i] ?></font></td></tr>
<tr><td><input name='<? echo $i ?>' type='radio'><font class='b12'>C. <? echo $_SESSION['answer3'][$i] ?></font></td></tr>
<tr><td><input name='<? echo $i ?>' type='radio'><font class='b12'>D. <? echo $_SESSION['answer4'][$i] ?><br><br></font></td></tr>
```

Appendix B: Survey Form

UNIVERSITY OF MALAYA

This survey is for secondary upper students which are currently studying form 4 and form 5 and taking Biology as one of their compulsory subjects to study. The purpose of this survey is to collect the feedback from students on their Biology studies. Please tick (□) at the box beside your desired answer. Thank you for your precious time in answering this questionnaire. Your co-operation is very much appreciated.

1. Your gender

   □ Male □ Female

2. Your current level of study

   □ Form 4 □ Form 5

3. Do you think that Biology is an interesting subject to study?

   □ Yes □ No

4. Can you cope up well with what was being taught in classroom by teacher?

   □ Yes □ No

5. Besides textbooks, what else materials do you often refer to in order to gain extra knowledge of Biology?

   □ Reference Books □ Search Online □

   Others_____

6. Do you online?

   □ Yes □ No

   - If yes, where do you online usually?

     □ Home □ Cyber Café □ School

   - How often do you online?

     □ Everyday □ More than 4 days a week □ Once or twice a week

7. Do you prefer learning biology in classroom or learning biology through an interactive 3D multimedia way online?

   □ Classroom □ Online

8. Have you ever tried any interactive 3D multimedia learning biology tools online before?

   □ Yes □ No

- If yes, please state out what are the online learning tools you are using or used before.

_____

9. Do you agree that an interactive 3D multimedia biology learning tool is able to help you in your understanding of biology concept?

   ☐ Yes ☐ No

10. If there is an interactive 3D multimedia biology learning tool available online, will you visit it frequently?

    ☐ Yes ☐ No

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http://www.fsktm.um.edu.my

APPENDIX C: User Manual

1. Introduction
2. System Objective
3. System Overview
4. User Manual
    - 4.1 Index
    - 4.2 Register
    - 4.3 Home
    - 4.4 Edit Profile
    - 4.5 Login Unsuccessful, Logout Success, Register Success
    - 4.6 About Us
    - 4.7 3DiC
        - 4.7.1 How to use Cosmo Player
    - 4.8 Animation
    - 4.9 Tutorial
5. Administrator User Manual
    - 5.1 Admin Login
    - 5.2 Admin Main Menu
    - 5.3 Add New Admin
    - 5.4 View/Edit Admin Record
    - 5.5 View/Edit Users Record
    - 5.6 Add New Tutorial Questions
    - 5.7 View/Edit Tutorial Questions
    - 5.8 View/Edit Feedback

1. INTRODUCTION

3DiC, a system that will provide well organized interactivity and navigations in order to response to users during their learning period. Interaction is a must in order to enhance motivation, communication, and an assorted range of skills and intellectual development in the distance educational process. It is clear that 3D interactions with multimedia elements allowed learners to develop faster than in a normal classroom. The use of computer training tools where student interacts with a computer model is inexpensive, remote and good feedback. Explanations by using 3D visualizations are clearer, more interesting, more attractive and more effective if compared to just plain text explanations and static illustrations.

2. SYSTEM OBJECTIVES

- Provide secondary upper Biology learners an interesting and interactive way of studying Biological cells and processes through interactive 3D multimedia learning tool.
- Provide an electronic-based learning environment according to the concept of smart school which was launched since July 1997 in Malaysia.
- To encourage educators and students to try out creative and innovative ideas in the use of multimedia.
- Provide beginners in Biological subject a fundamental concept of Biology cells and cell division processes so that it will be easier for learners to continue cope up with further Biological knowledge in future.

3. SYSTEM OVERVIEW

Interactive 3D Multimedia Learning Tool in Biology is being created in order to provide users a 3D element multimedia study environment in Biology subject. The system contains of basically three main divisions which are:-

i) 3DiC

Users can interactively view the structure of a bacteria cell, plant cell as well as an animal cell.

ii) Animation

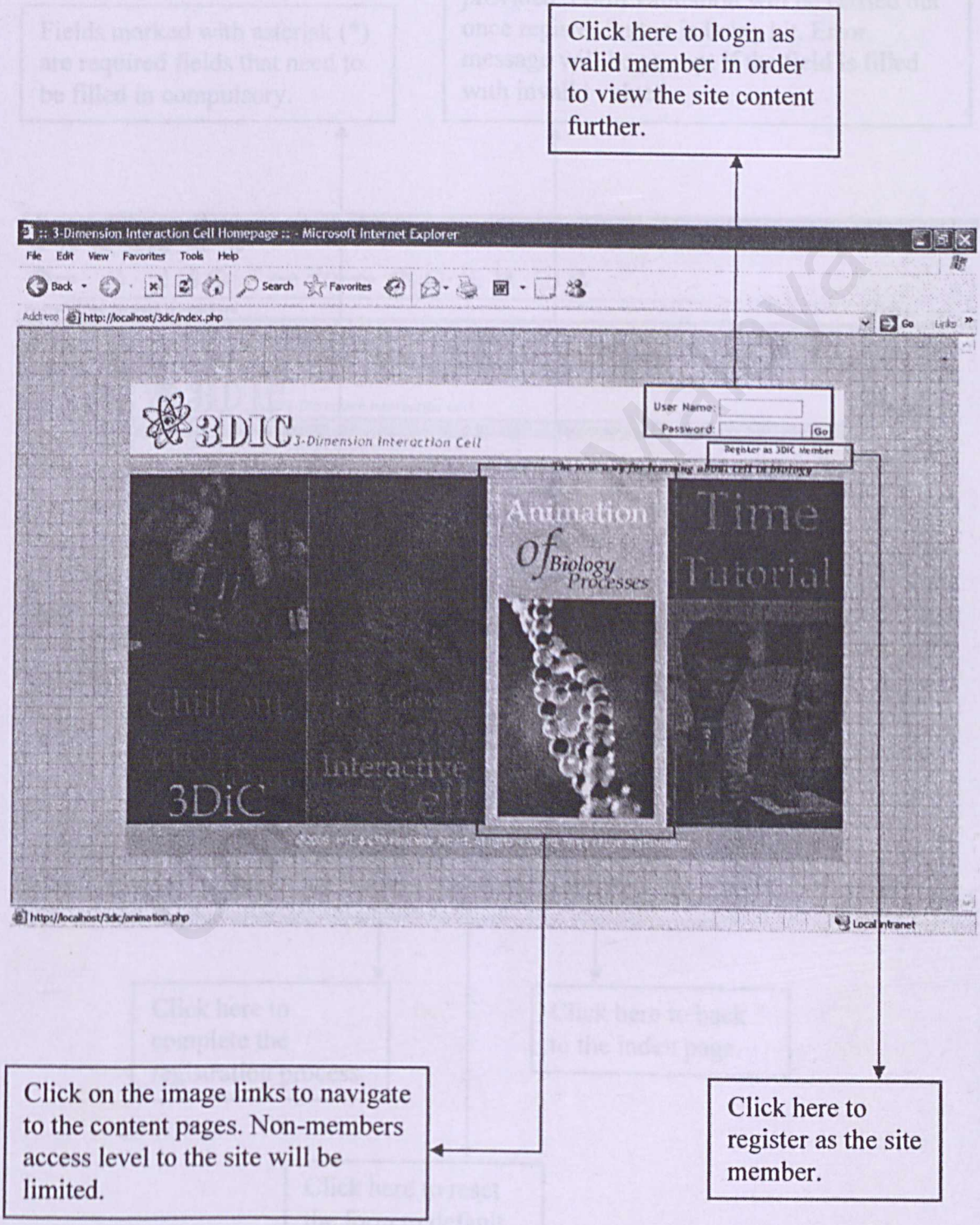
Users are able to view the entire animated biological processes that happened in human cell.

iii) Tutorial

Users are free to self-test themselves on their knowledge of Biology concepts within the topic about cell.

4. USER MANUAL

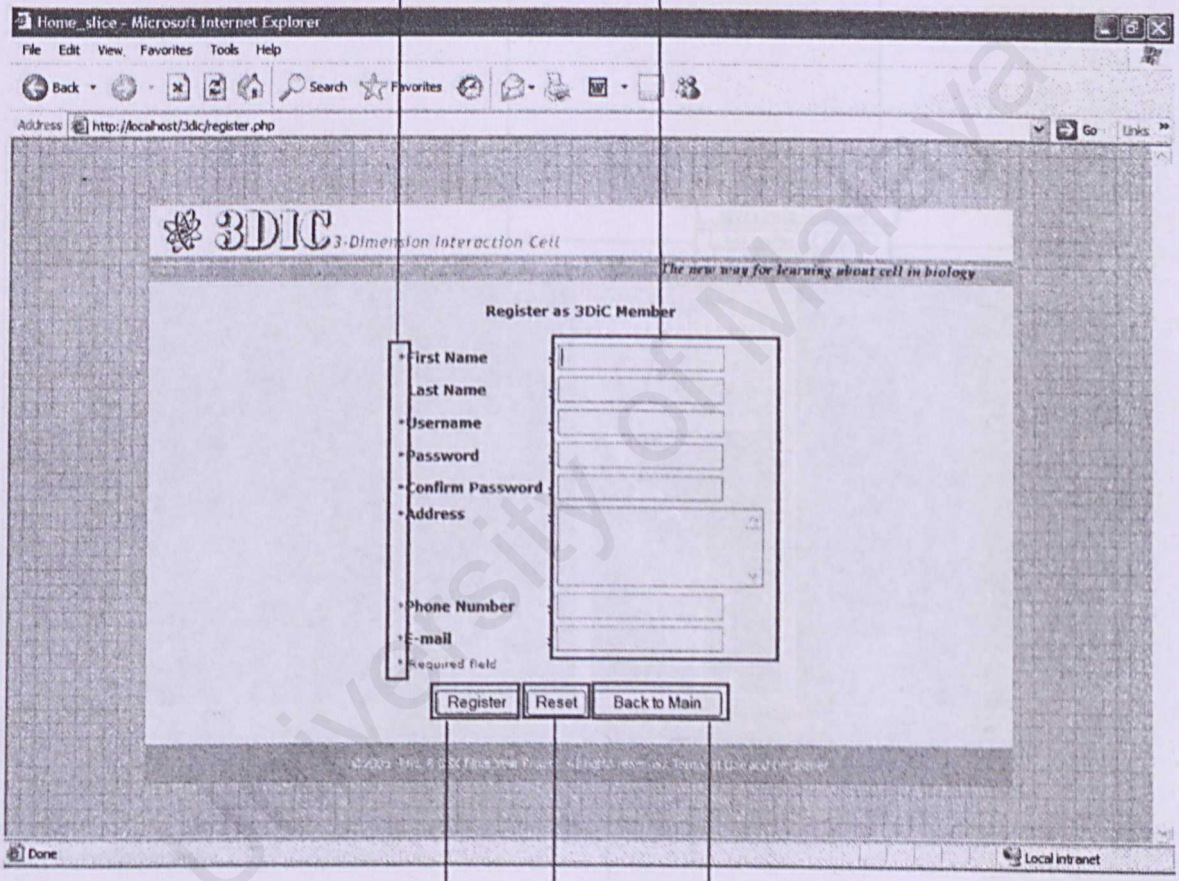
4.1 Index



4.2 Register

Fields marked with asterisk (*) are required fields that need to be filled in compulsory.

Fill in the information in the textbox provided. Form validation will be carried out once register button is being hit. Error message will be prompt if the field is filled with invalid values.

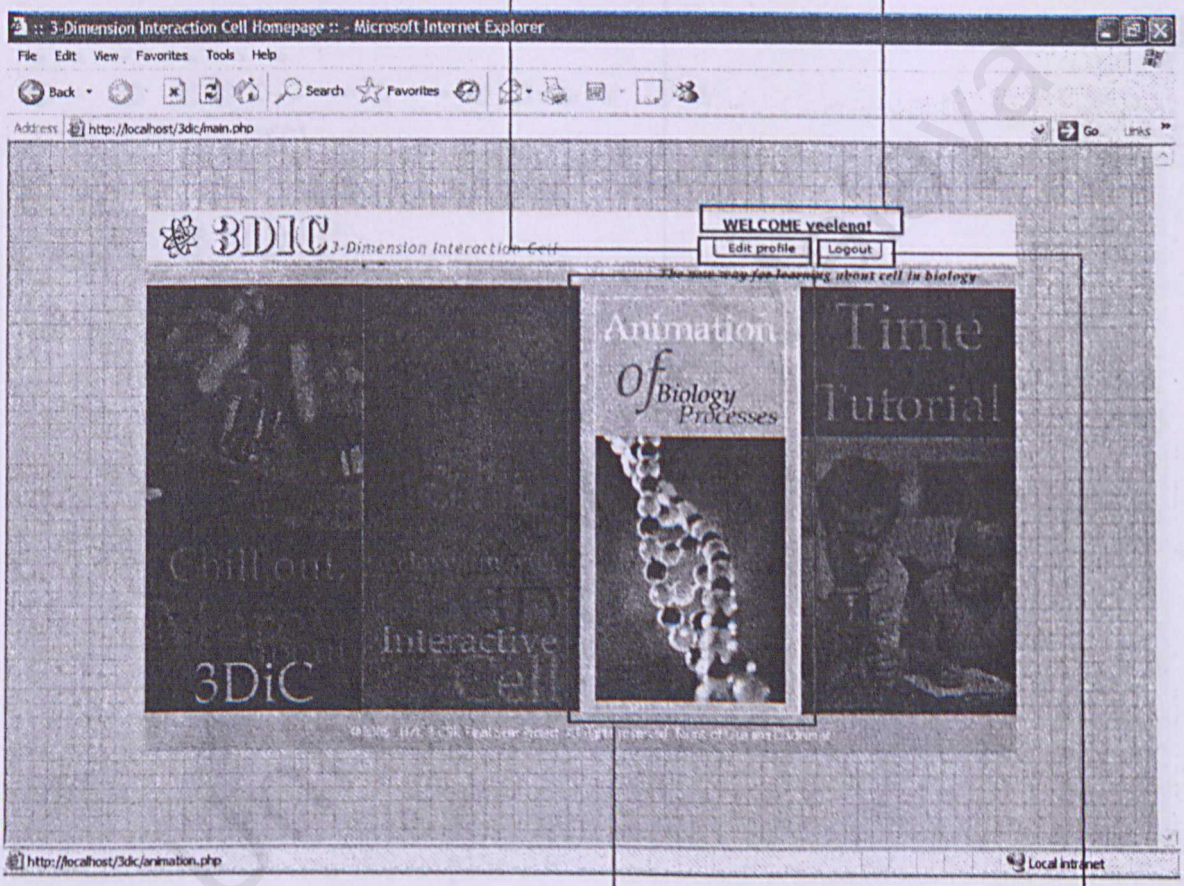


Click here to complete the registration process.

Click here to back to the index page.

Click here to reset the form to default.

4.3 Home



Click here in order to edit or update member profile.

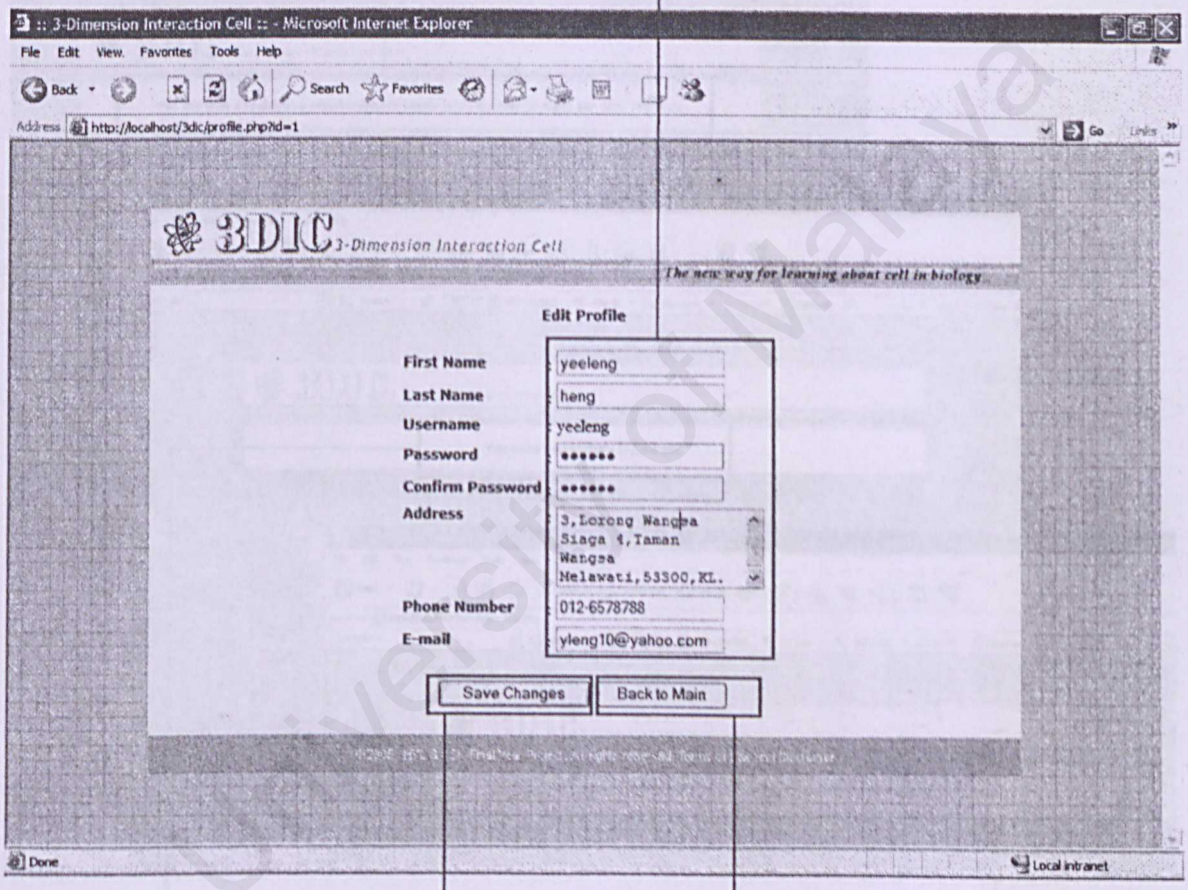
A welcome message with member username is shown here.

Click on the image links in order to view the site content further. As a member of the 3DiC site, access to all of the site pages is allowed.

Click here to logout from the site and return to the index page.

4.4 Edit Profile

Previously entered member's data will be retrieved and prompt inside textbox. Members are required to enter latest information into the textbox provided replacing the previous data. As in register page, form validation will be carried out here as well. Error message will be prompt out if invalid value is being entered into the fields.

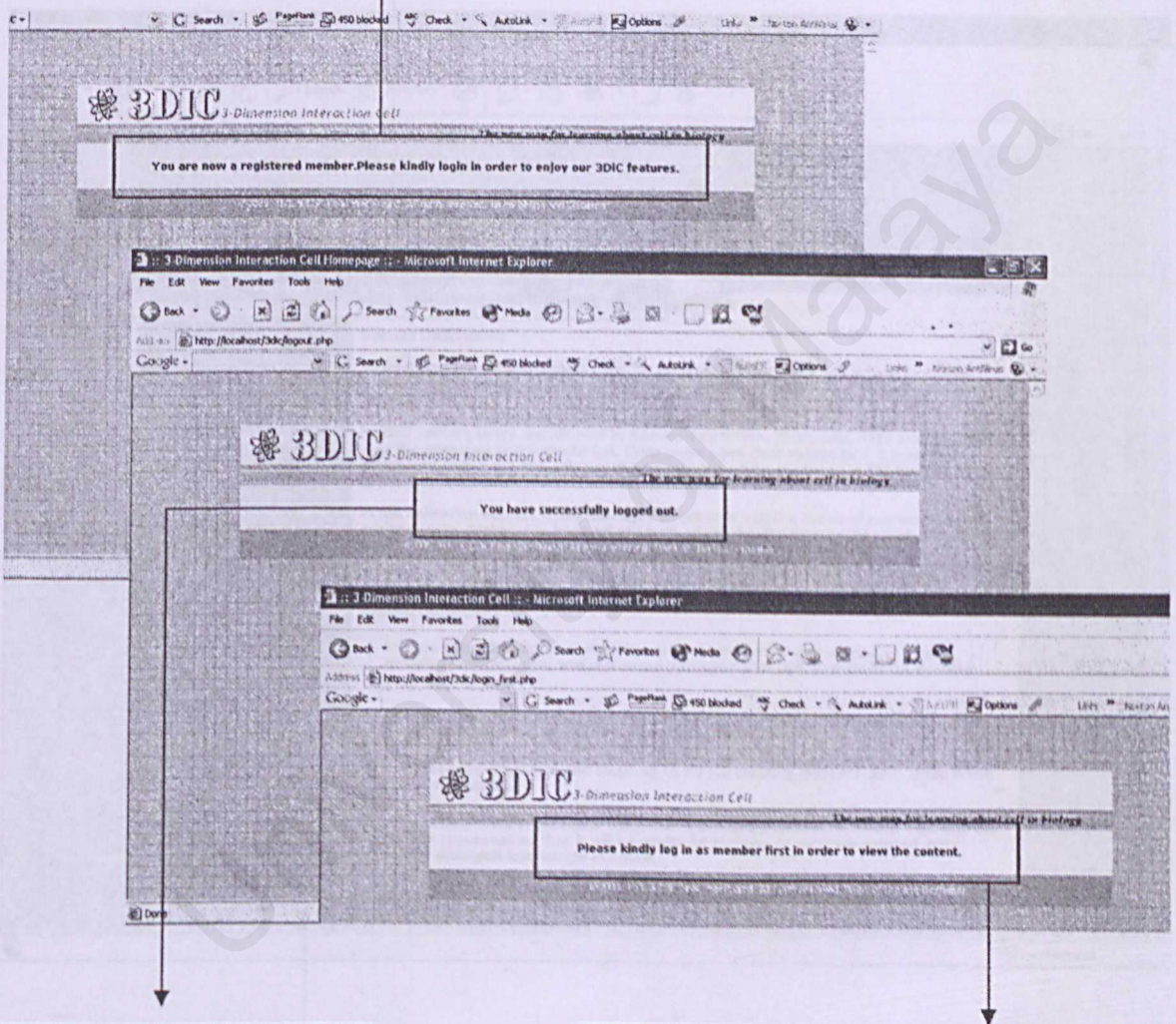


Click here to save the changes made and complete the profile update process.

Click here to back to the home page.

4.5 Login Unsuccessful, Logout Success, Register Success

This page will be prompt whenever a user has successfully completed the register form in the register page. The page will then automatically return to the index page after 2 seconds. Users can then log into the site by entering correct username and password into the field.

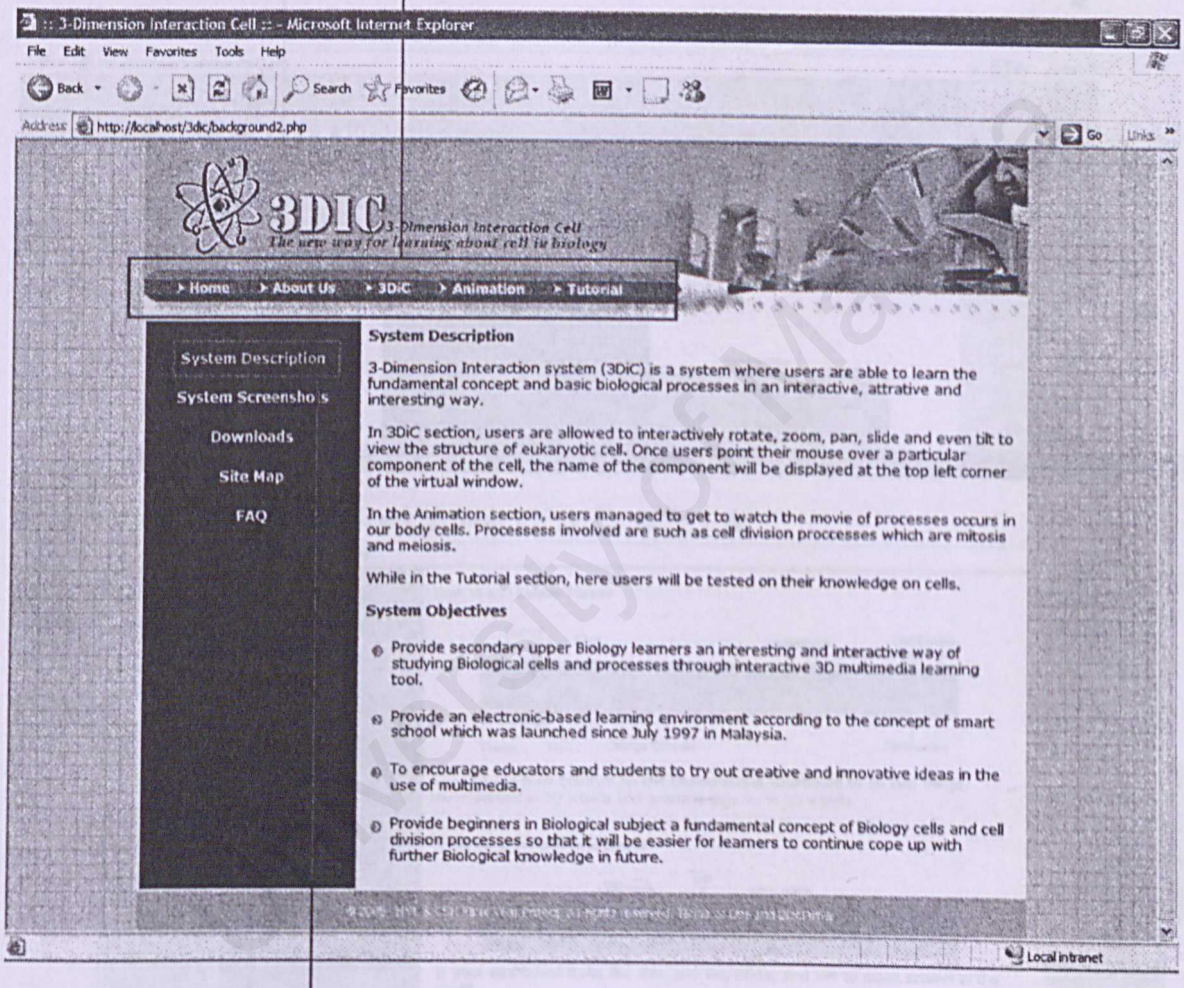


This page will be prompt whenever a user clicks on a logout button link. The page will then automatically return to the index page after 2 seconds.

This page will be prompt whenever a user entered an invalid username and/or password, or hitting the go button by leaving the username and password fields blank, or they are not yet a registered member of the site. The page will then automatically return to the index page after 2 seconds.

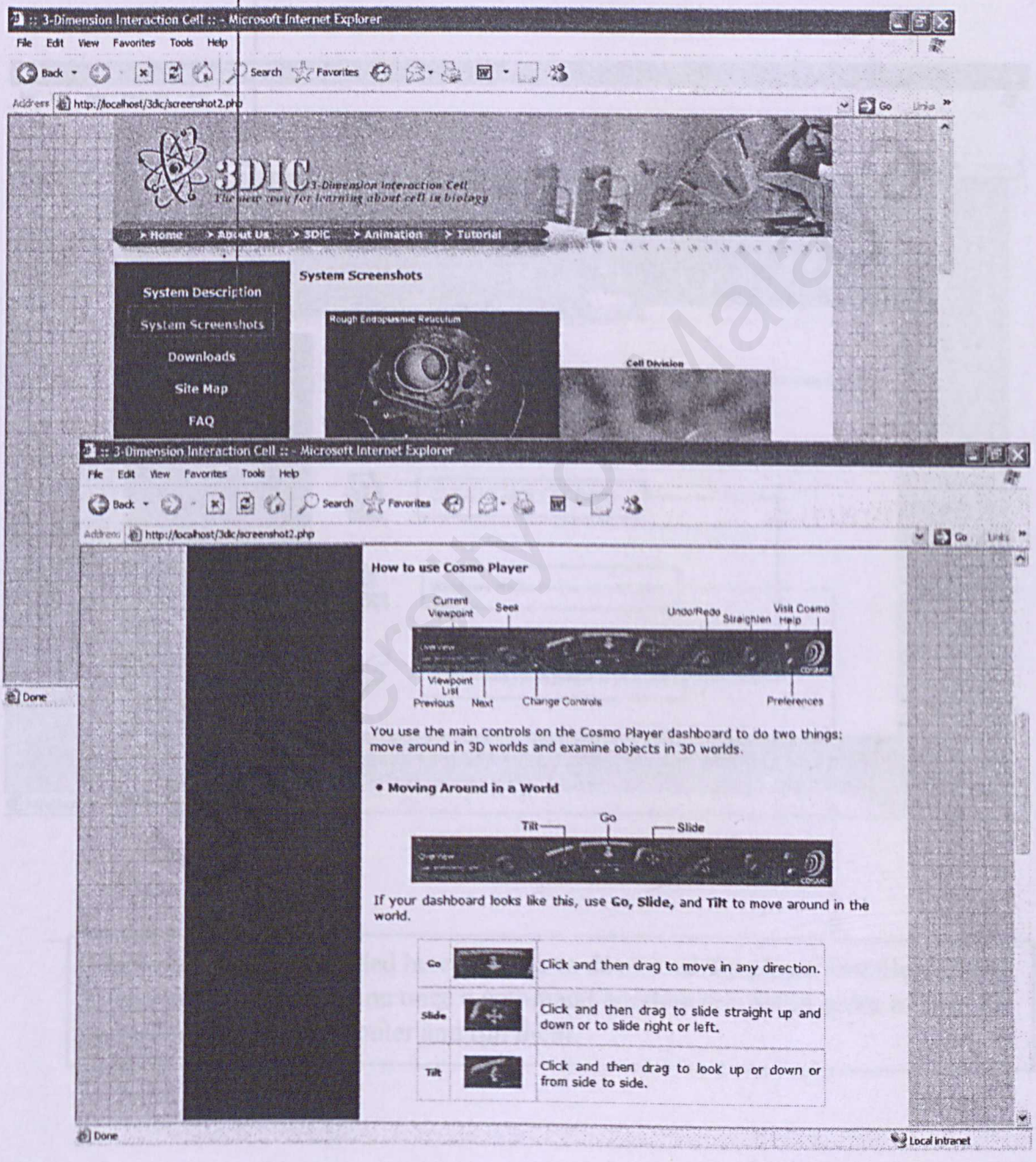
4.6 About Us

Click on the button links available on the menu bar here to navigate through the site. Only Home and About Us pages are able to be accessed by both members and non-members users.

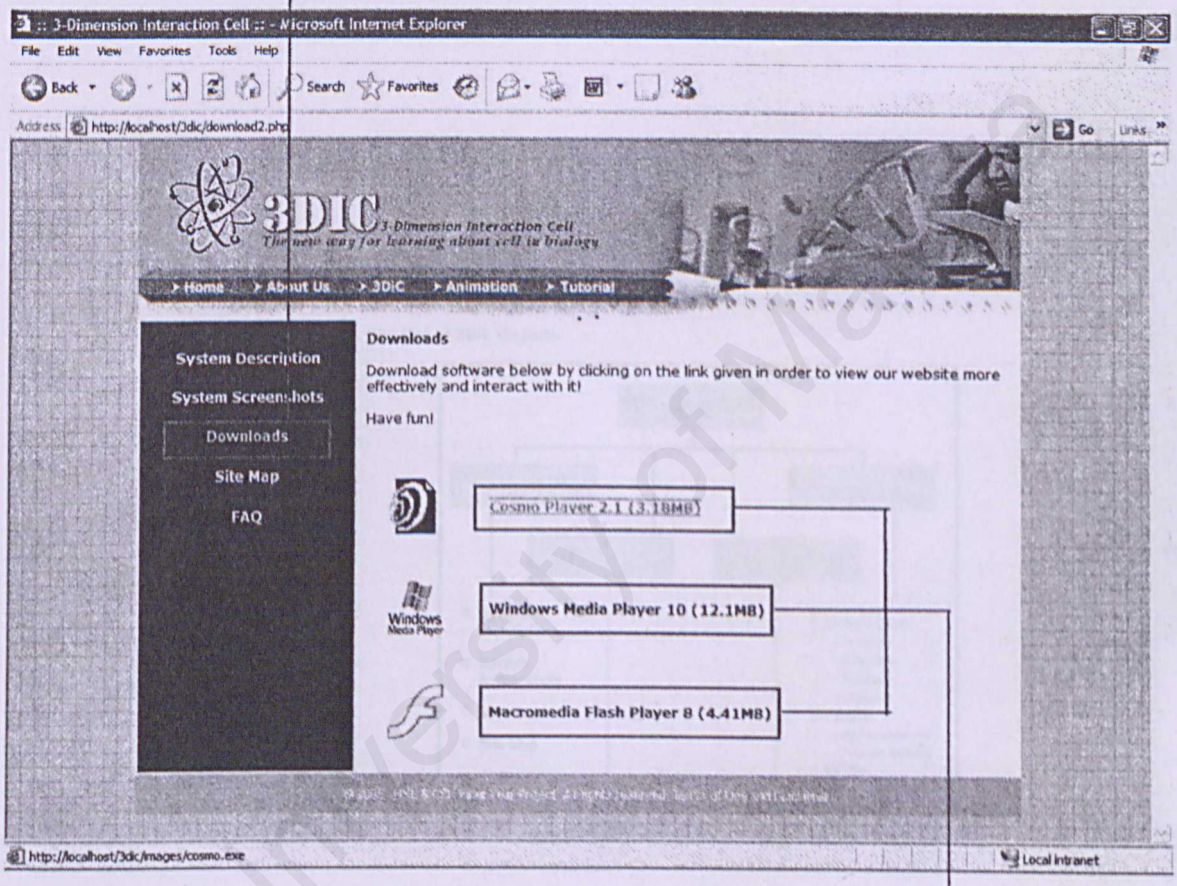


Click on this link to navigate to the system description page to know more about the system overview and its objectives.

Click on this link to navigate to the system screenshots page to take a quick glance on some print screens of the site and learn how to interact and navigate within the 3D environment by using Cosmo Player.

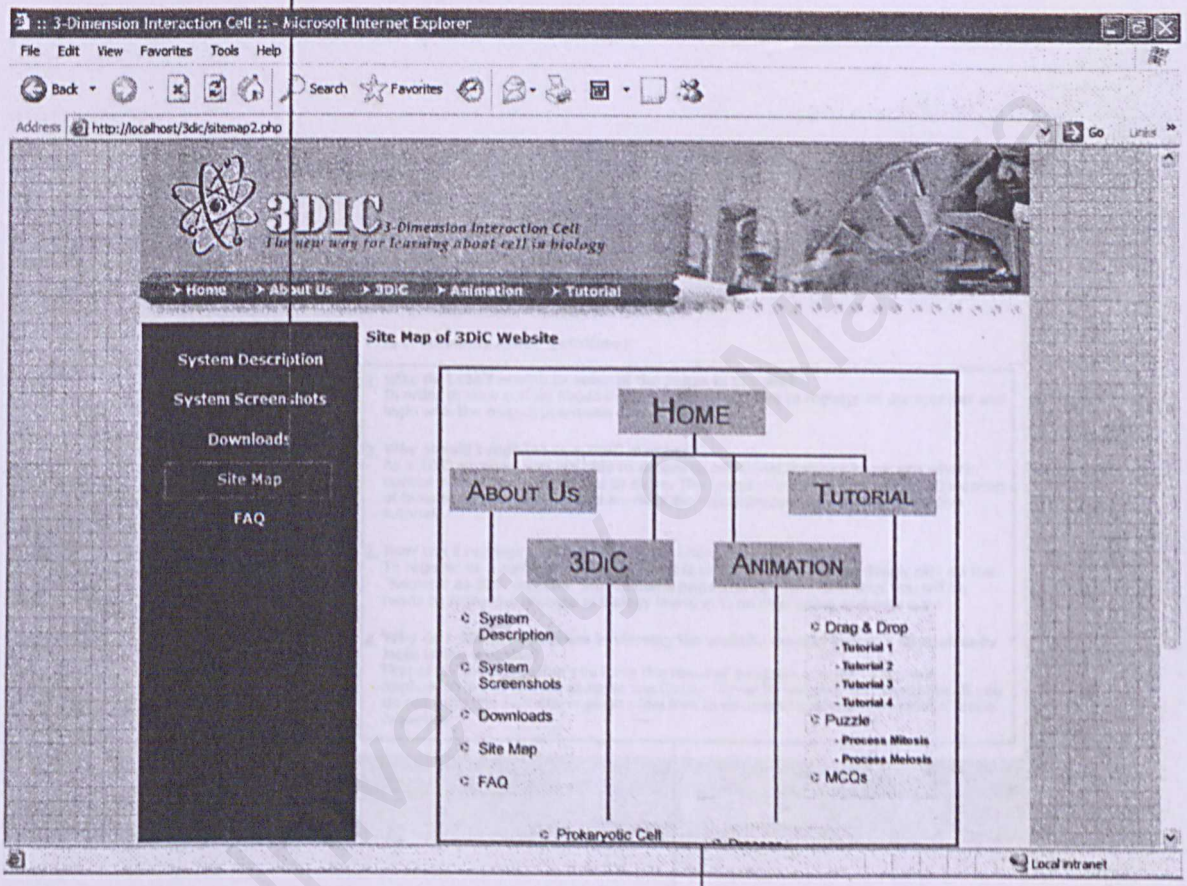


Click on this link to download the players that are required to play some files within the website.



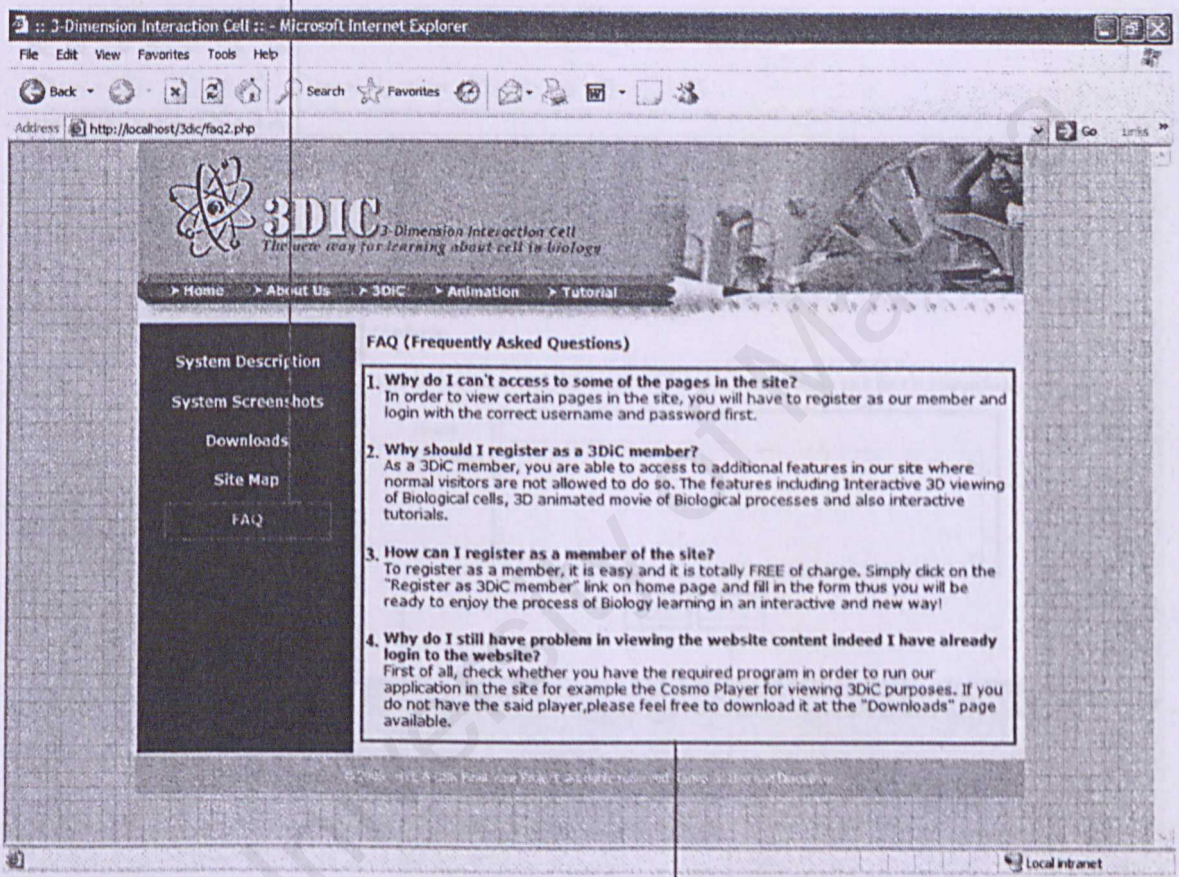
Click on the links provided here in order to download the player installers stated. Click on the "Save" button once a command window prompt in order to save the installers into your computer and run them.

Click on this link to view the site map of the site which gives users an overall overview of the site structure through a tree map summarizing the navigations of the site.



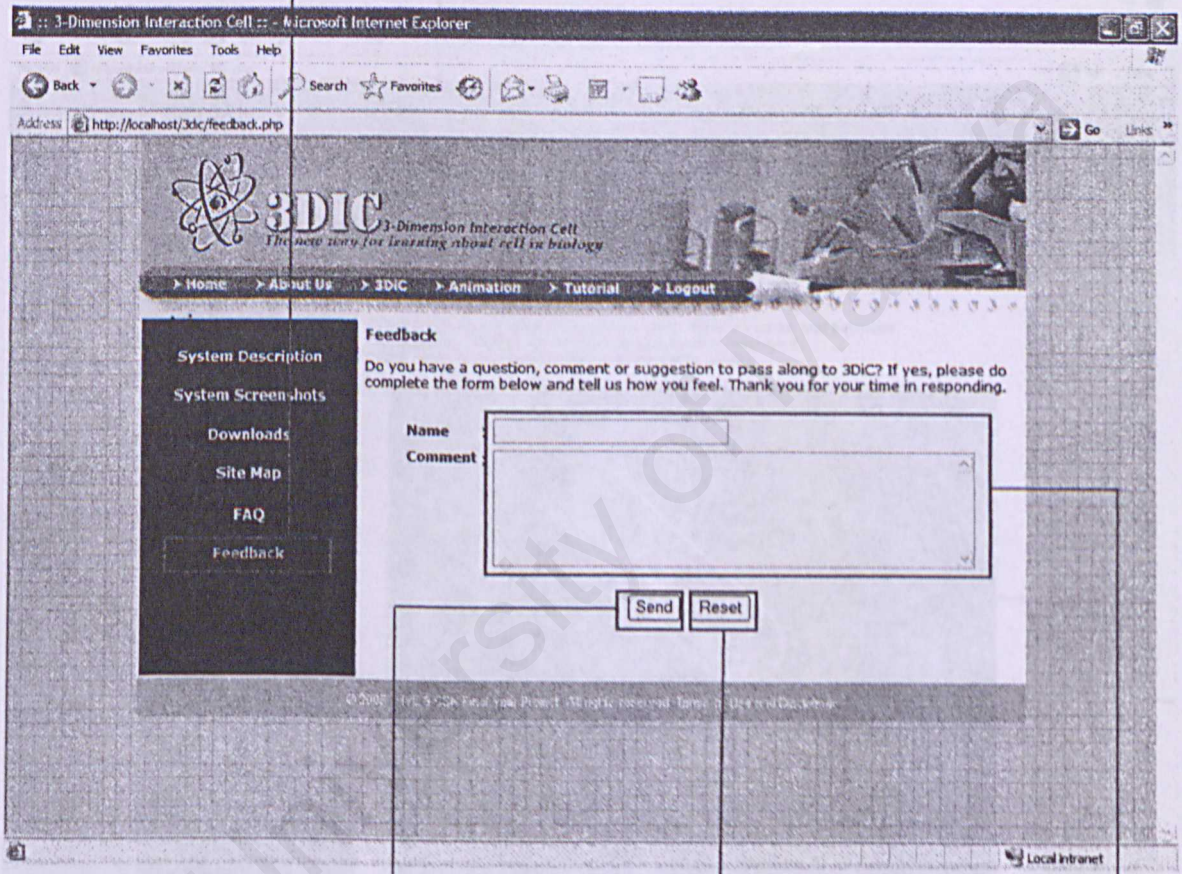
Click on image links available on this tree map in order to navigate to the page directly. In order to access member area sites, users are required to login as member first.

Click on this link to view the frequently asked questions and its detailed answers.



Here will be the list of questions and answers where users can refer to if they have any questions or doubt on the site.

Click on this link to send the comment or feedback regarding the site to the admin. This page is a member-only access page.



Click on this button to send the feedback.

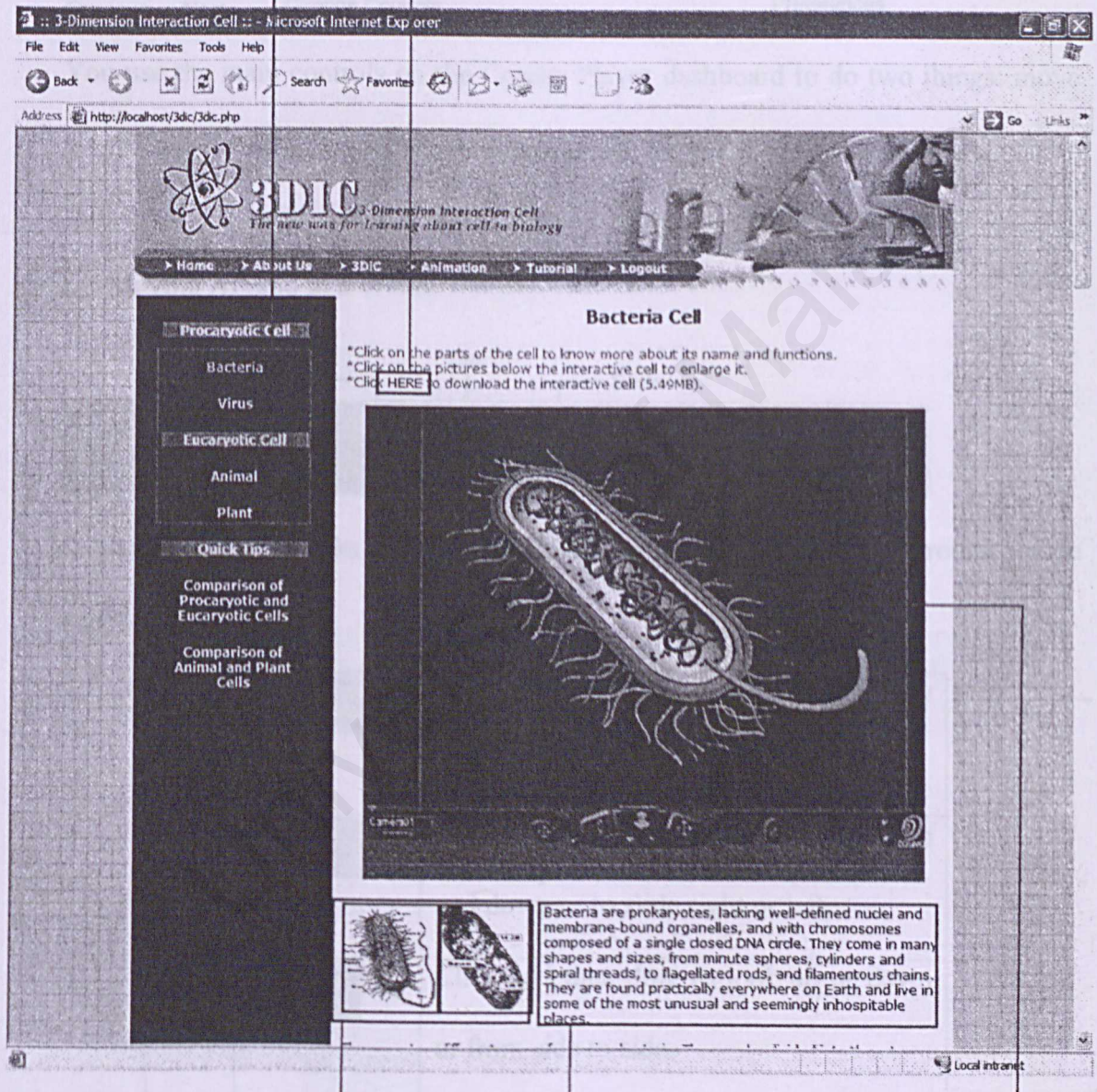
Click on this button to reset the form.

Fill in the name and the comment in the textbox provided

4.7 3DiC

Click on this link to view the interactive 3D VRML cell models.

Click on this link in order to download the VRML file for further learning purposes

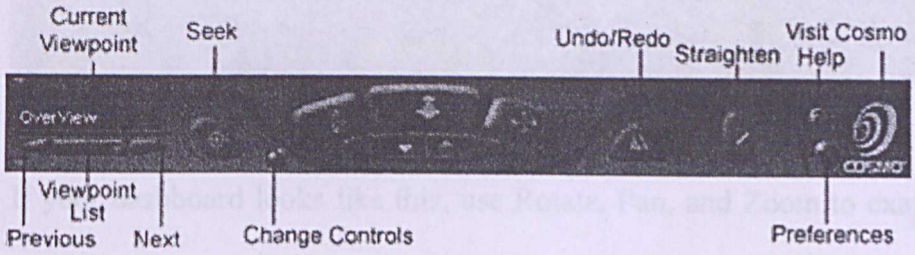


Click on the images in order to enlarge them.

These will be the detailed description for the cell.

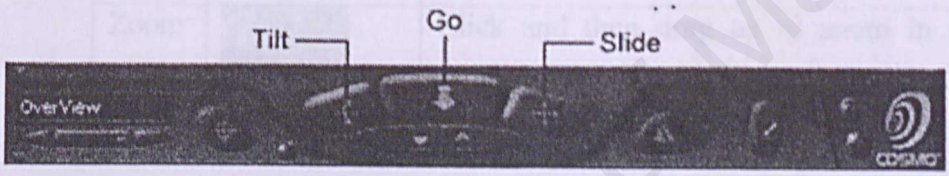
Users can click on a certain part of the cell in order to know more about the name and functions of the cell through a popup window.

4.7.1 How to use Cosmo Player



You use the main controls on the Cosmo Player dashboard to do two things: move around in 3D worlds and examine objects in 3D worlds.

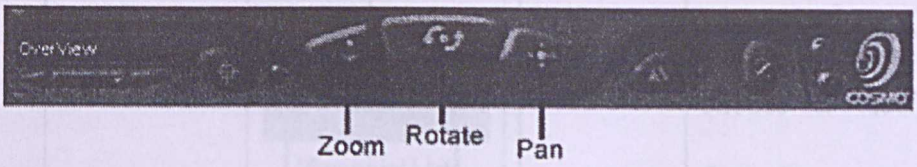
- Moving Around in a World



If your dashboard looks like this, use Go, Slide, and Tilt to move around in the world.

Go		Click and then drag to move in any direction.
Slide		Click and then drag to slide straight up and down or to slide right or left.
Tilt		Click and then drag to look up or down or from side to side.

- **Examining Objects**



If your dashboard looks like this, use Rotate, Pan, and Zoom to examine objects in the world.

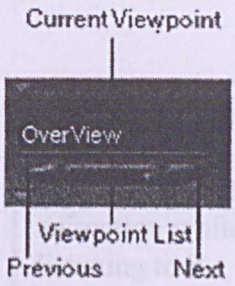
Rotate		Click and then drag to rotate an object.
Pan		Click and then drag to pan right, left, up, or down.
Zoom		Click and then drag up to zoom in or drag down to zoom out.

- **Switch Controls**

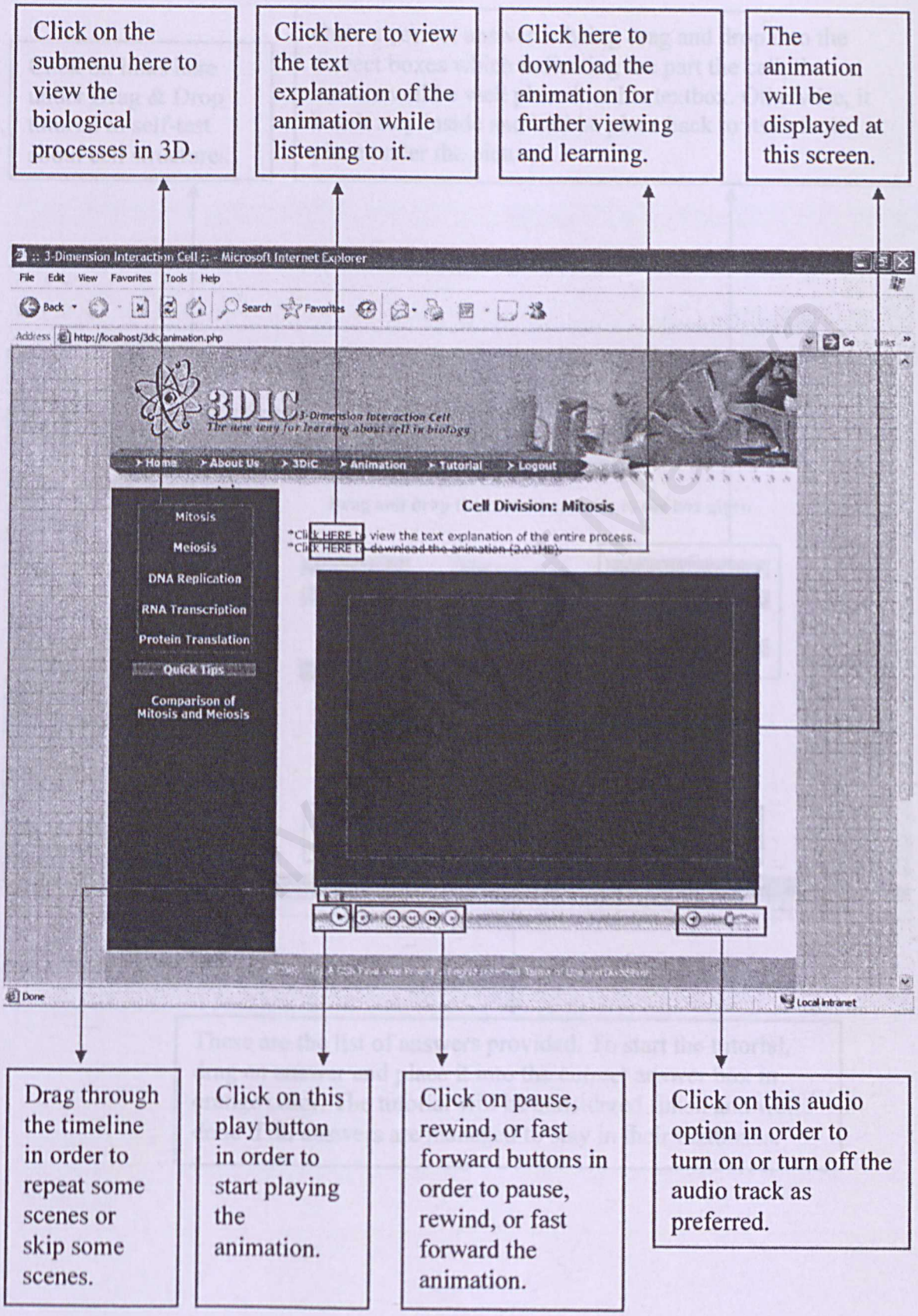
To switch from one set of controls to another, click Change Controls.

- **Other features**

Undo/Redo move	 Undo/Redo Move	Click Undo Move and Redo Move buttons to retrace your steps.
Seek		Click Seek and then click an object to move closer to it.

<table>
<tr><td>Viewpoint</td><td> 
</td><td><table>
<tr><td>Viewpoint List</td><td>Click the Viewpoint List button and choose a viewpoint from the pop-up list.</td></tr>
<tr><td>Next Viewpoint</td><td>Click to go to the next viewpoint in the list.</td></tr>
<tr><td>Previous Viewpoint</td><td>Click to go to the previous viewpoint in the list.</td></tr>
<tr><td>Current Viewpoint</td><td>Shows the last viewpoint you chose. Click to return to this viewpoint.</td></tr>
</table></td></tr>
<tr><td>Straighten</td><td>  </td><td>Click the Straighten button to return your view to an upright position.</td></tr>
<tr><td>Gravity/Float</td><td>  </td><td>When Gravity is selected, you cannot move off the ground.
When Float is selected, you can move off the ground with Slide</td></tr>
</table>

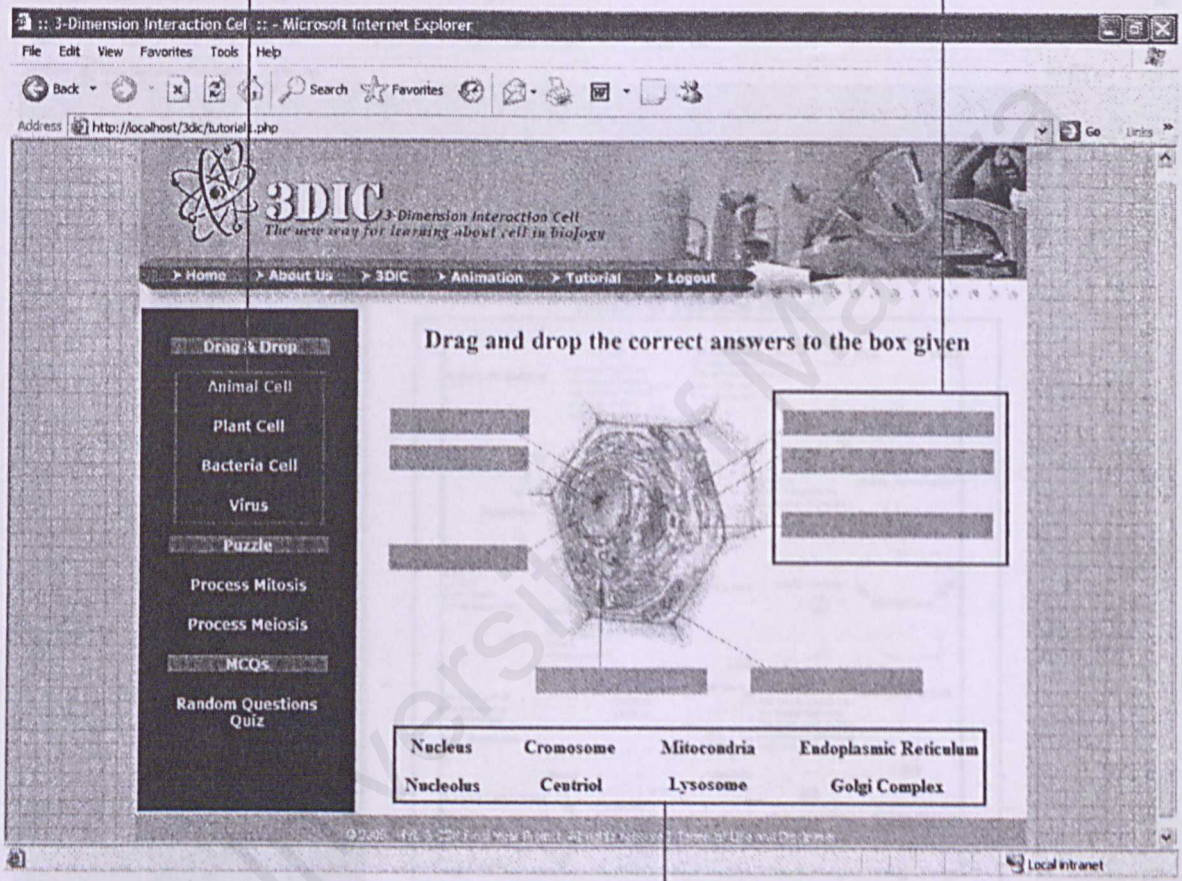
4.8 Animation



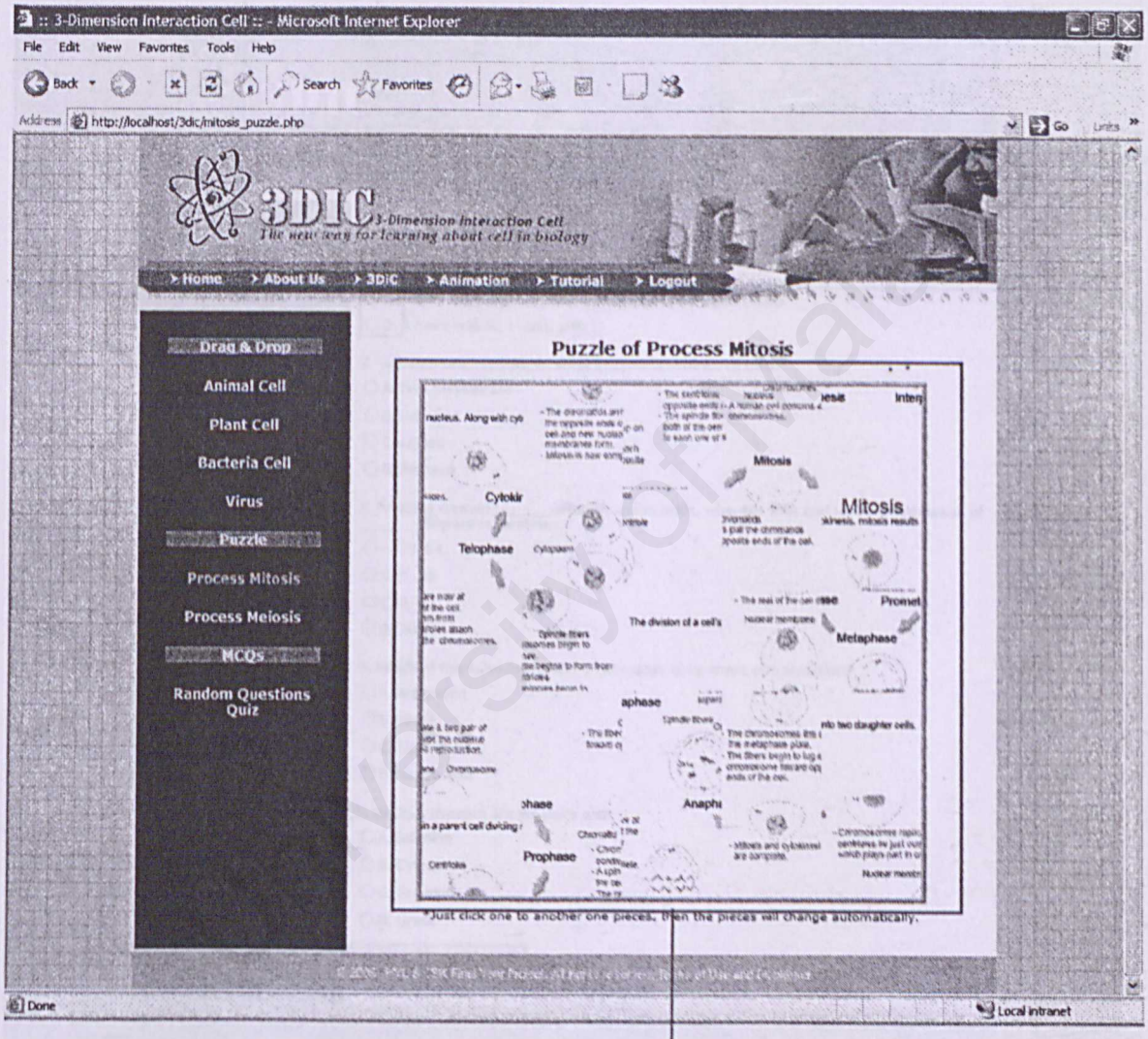
4.9 Tutorial

Click on links here under Drag & Drop tutorial to self-test about cell structures.

Once a correct answer is being drag and drop into the correct boxes which indicating the part the cell, the answer will be well placed in this textbox. Otherwise, it won't stay inside and will be place back to its default place under the picture.

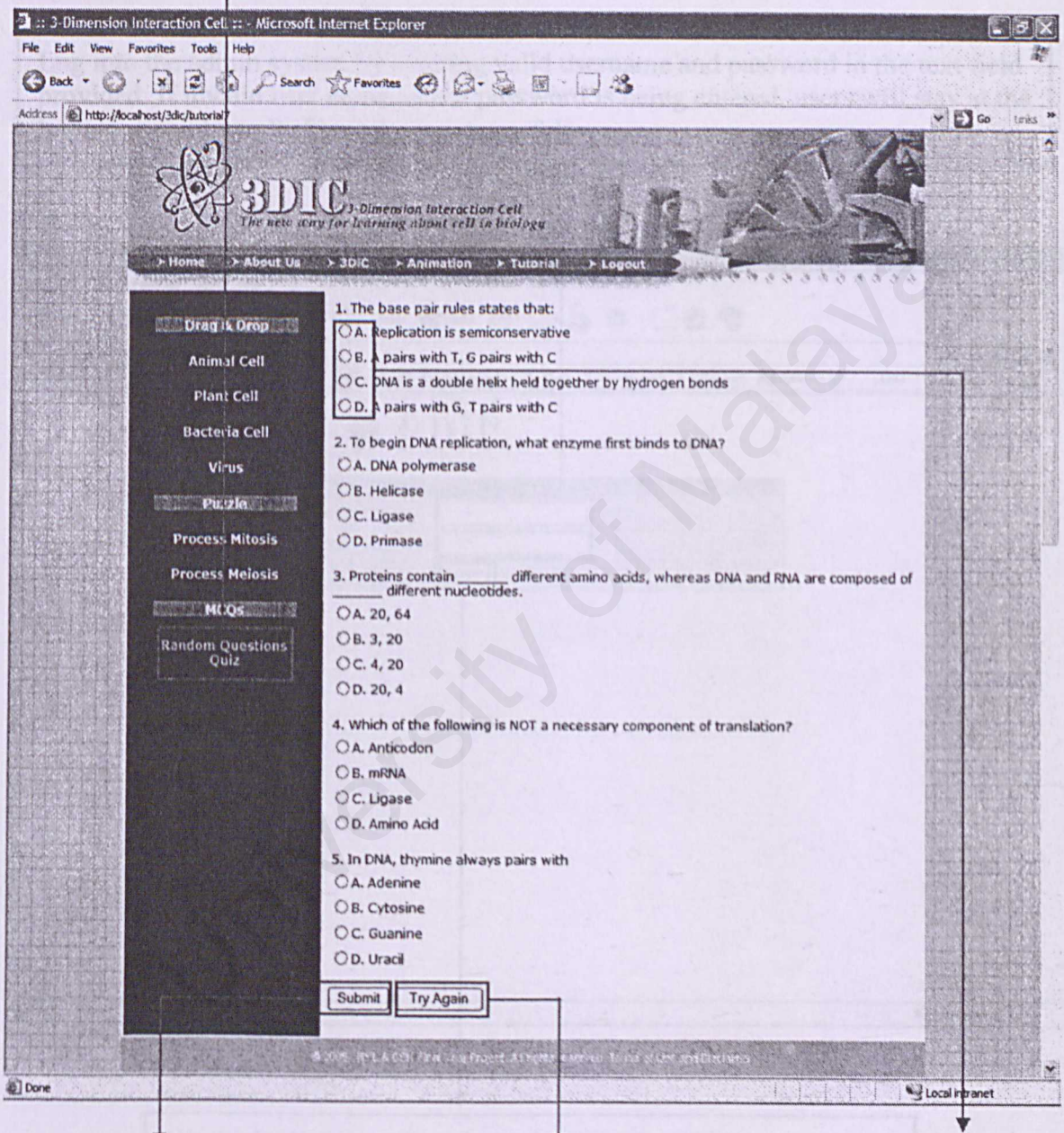


These are the list of answers provided. To start the tutorial, drag an answer and place it into the correct answer box in orange color. The tutorial will be considered finish and well done if all answers are managed to stay in their textboxes.



To start the tutorial, click on a piece of image, after that when you click on the other image for the second time, the location of the 2 images will be swapped. Keep on swapping the images until a complete image showing the correct phases of the process is gained.

Click on this link in order to self-test about processes of DNA replication, RNA transcription and protein translation by answering randomly generated MCQs (Multiple Choice Questions).



Click on the submit button in order to get the correct answers.

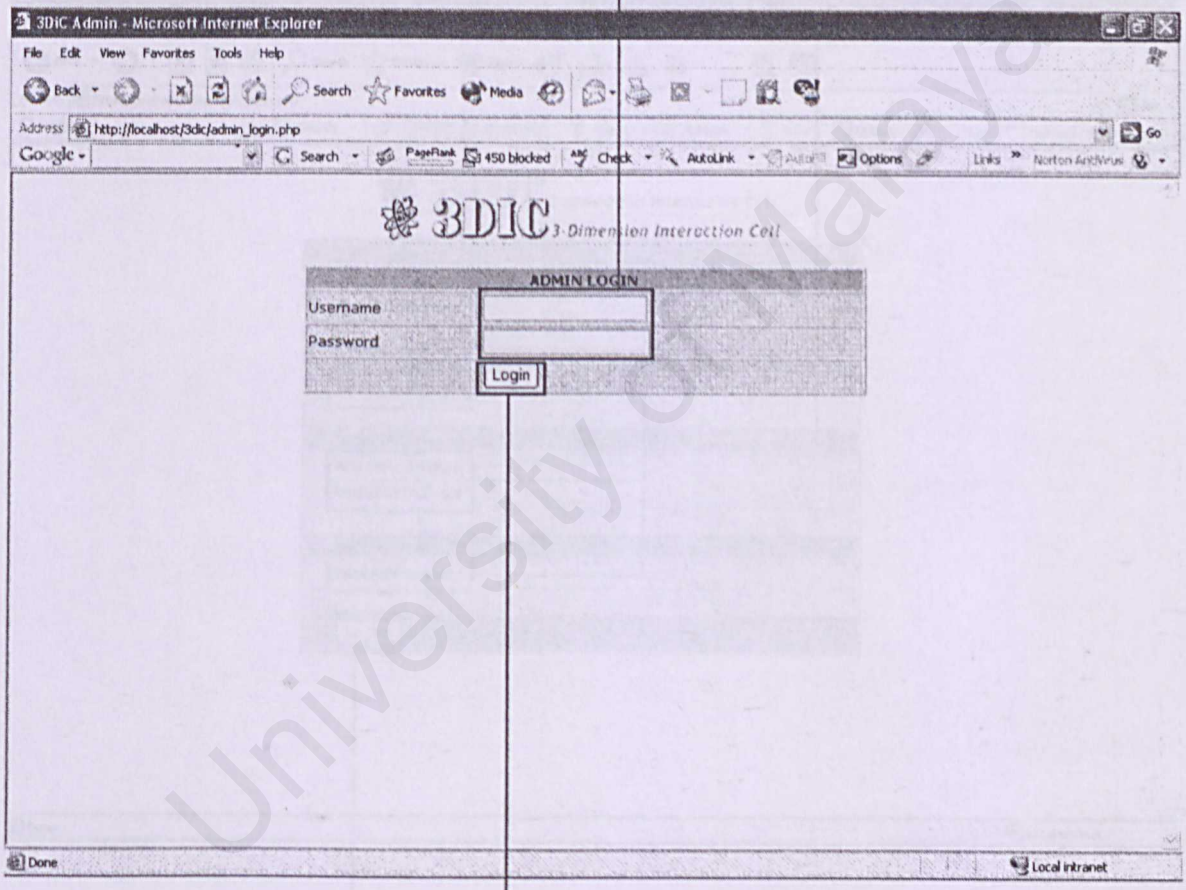
Click on the try again button to generate another set of random questions.

Choose the correct answers by clicking on the radio buttons provided.

5. ADMINISTRATOR USER MANUAL

5.1 Admin Login

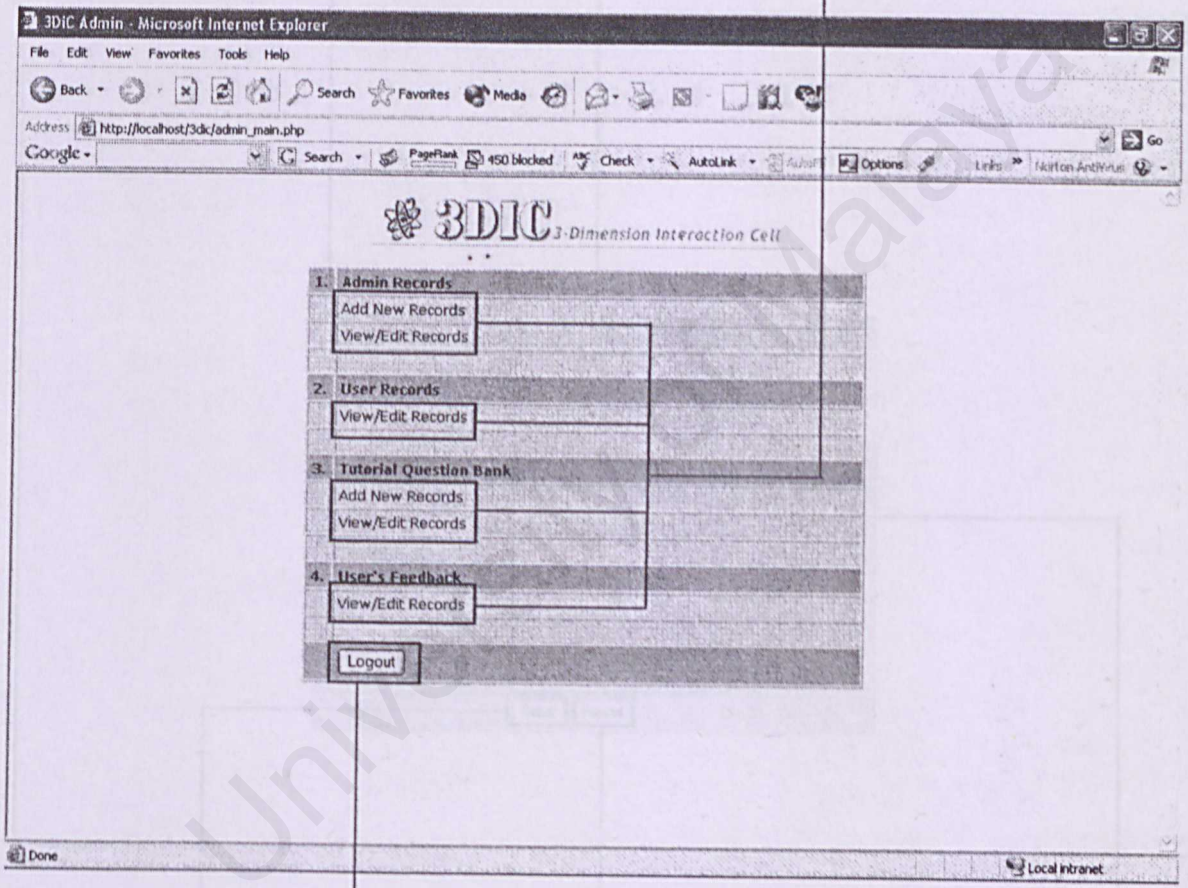
Log into the admin system by entering valid username and password in the text field provided. If invalid user name and/or password is being entered, users will stay at the login page and won't able to login successfully.



Hit the login button in order to log into the admin system as a valid administrator.

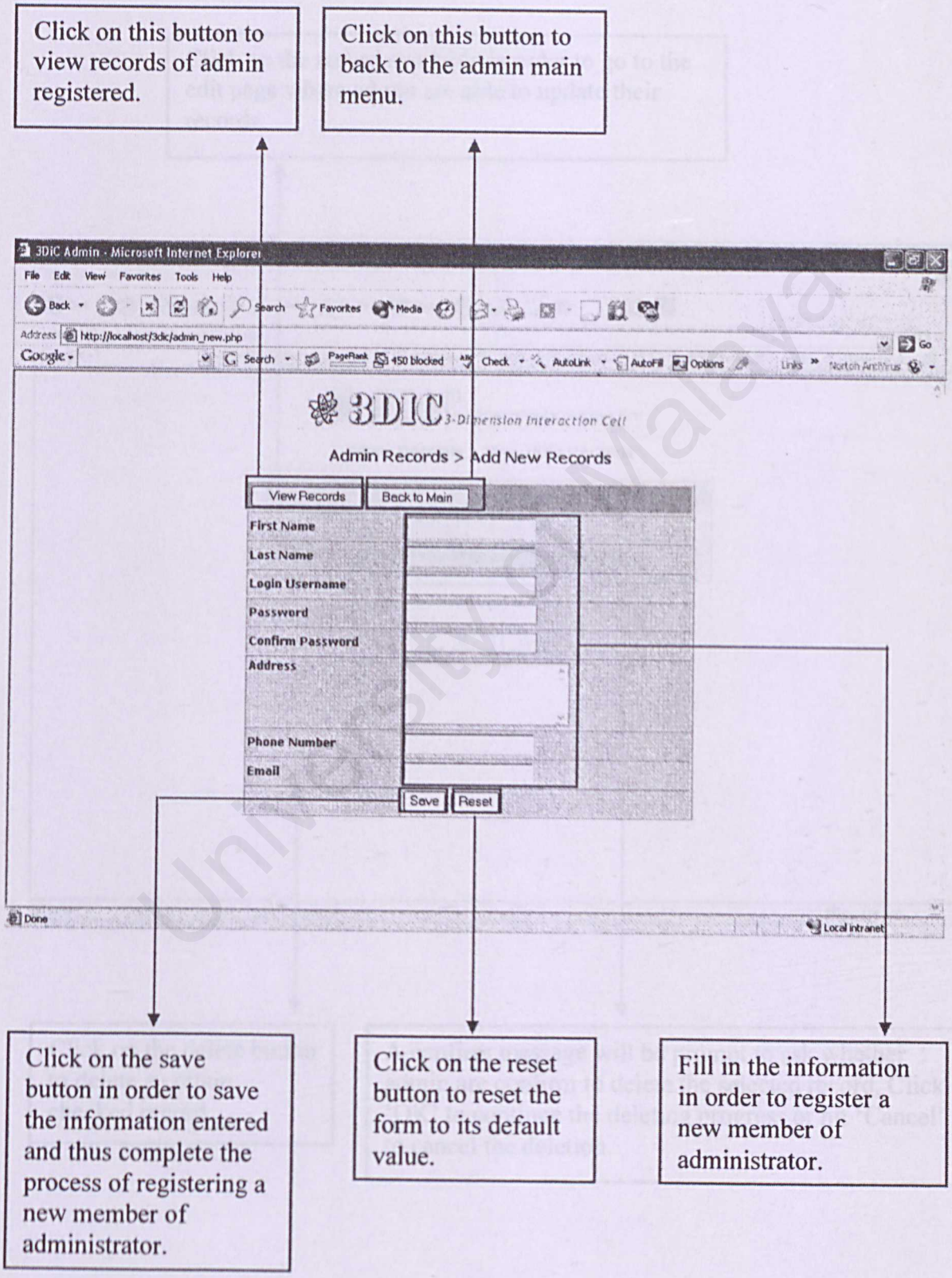
5.2 Admin Main Menu

These are the options available for administrators and the tasks they are able to carry out with. Click on the links of task to carry out the function.



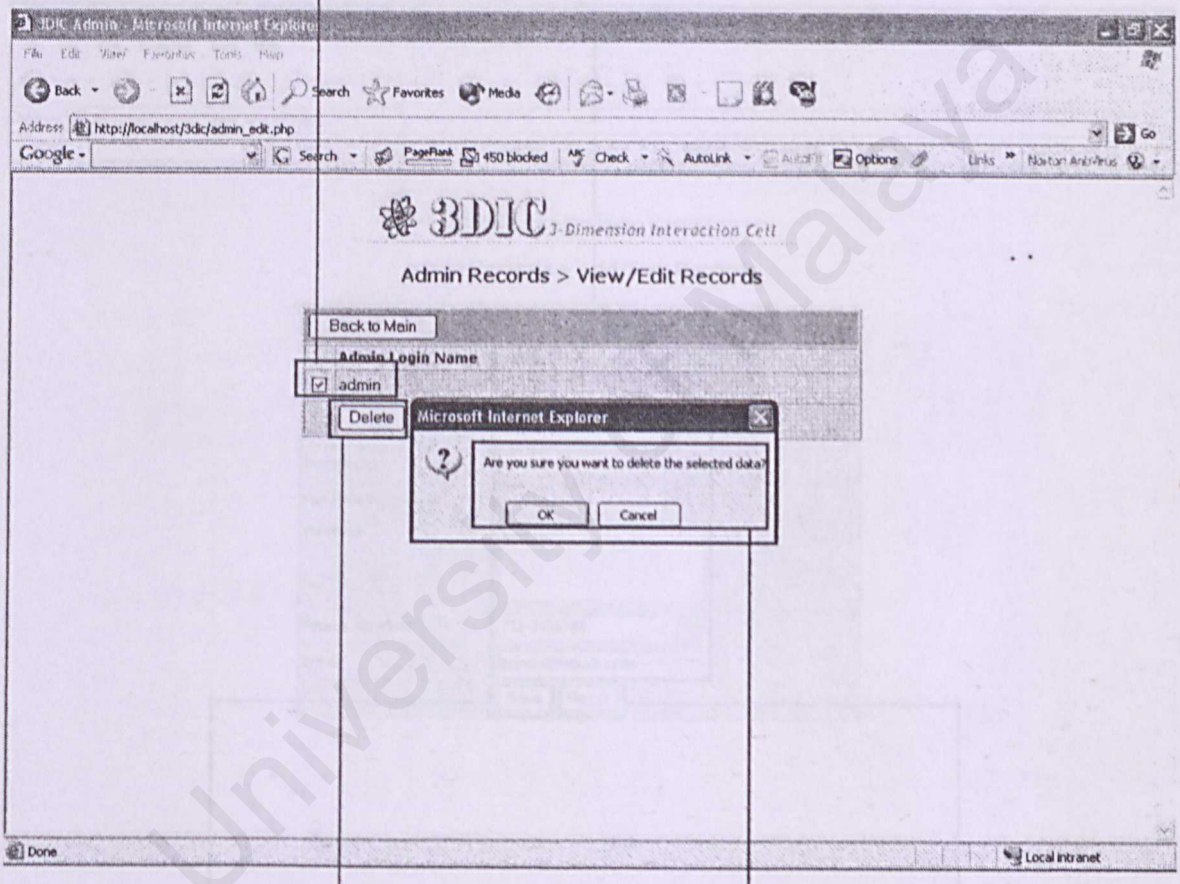
Hit the logout button in order to logout from the system.

5.3 Add New Admin



5.4 View/Edit Admin Record

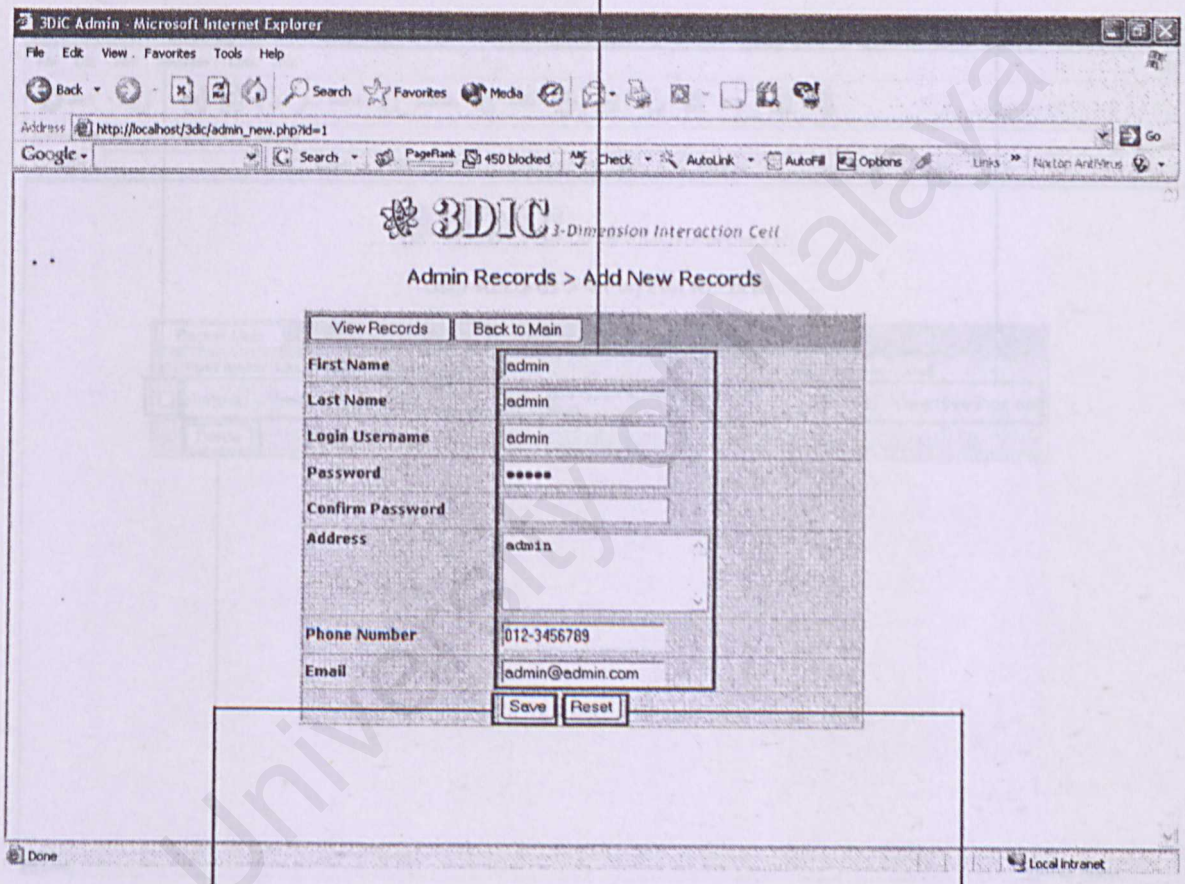
Click on the record available in order to go to the edit page where admin are able to update their records.



Click on the delete button to delete a certain checked record.

A confirm message will be prompt to ask whether admin are confirm to delete the selected record, Click 'OK' to continue the deleting progress or hit 'Cancel' to cancel the deletion.

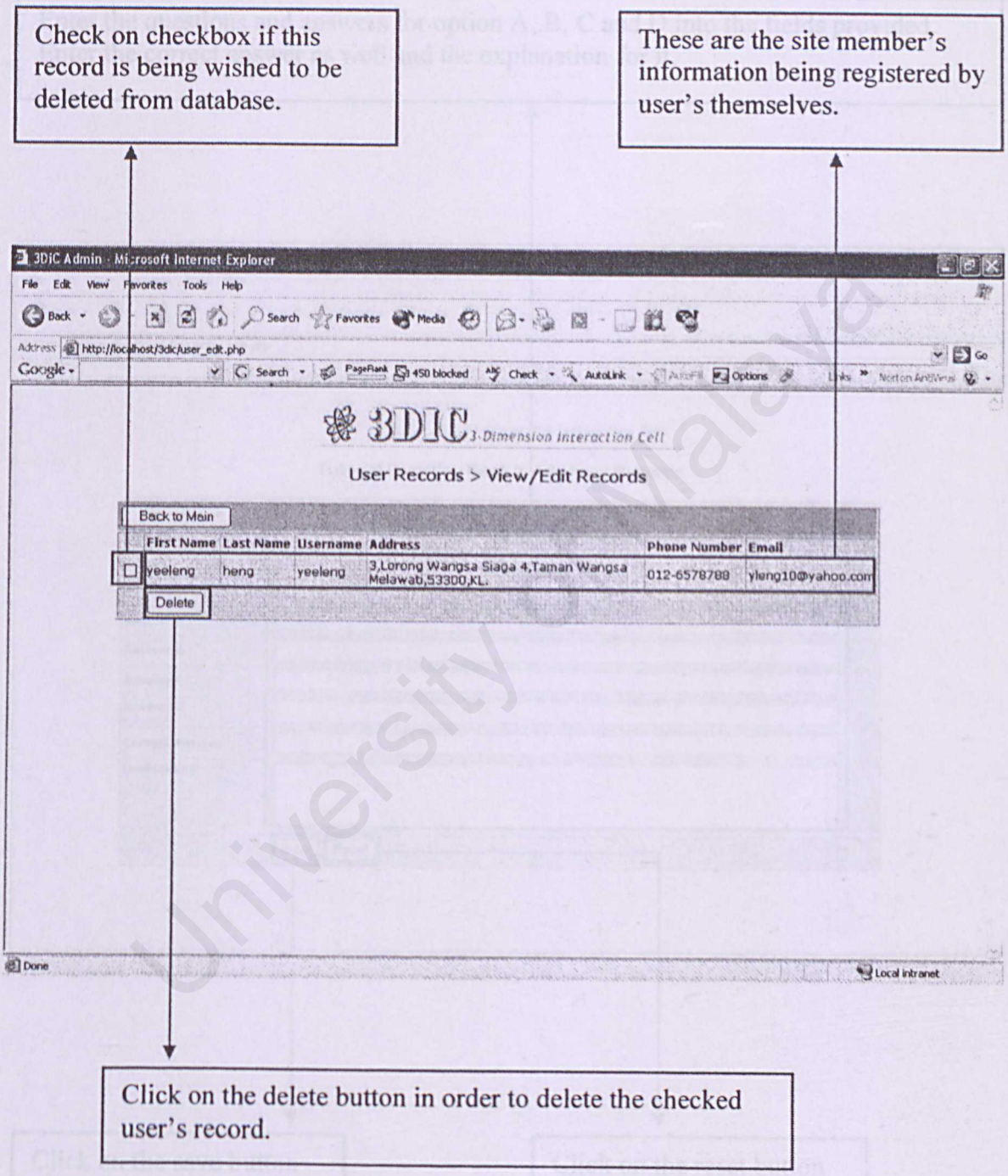
These are the values that are previous being stored. Simply replace this information with the latest data in order to update it.



Click on the save button to save the latest changes made on admin information.

Click on the reset button to reset the form to its default values.

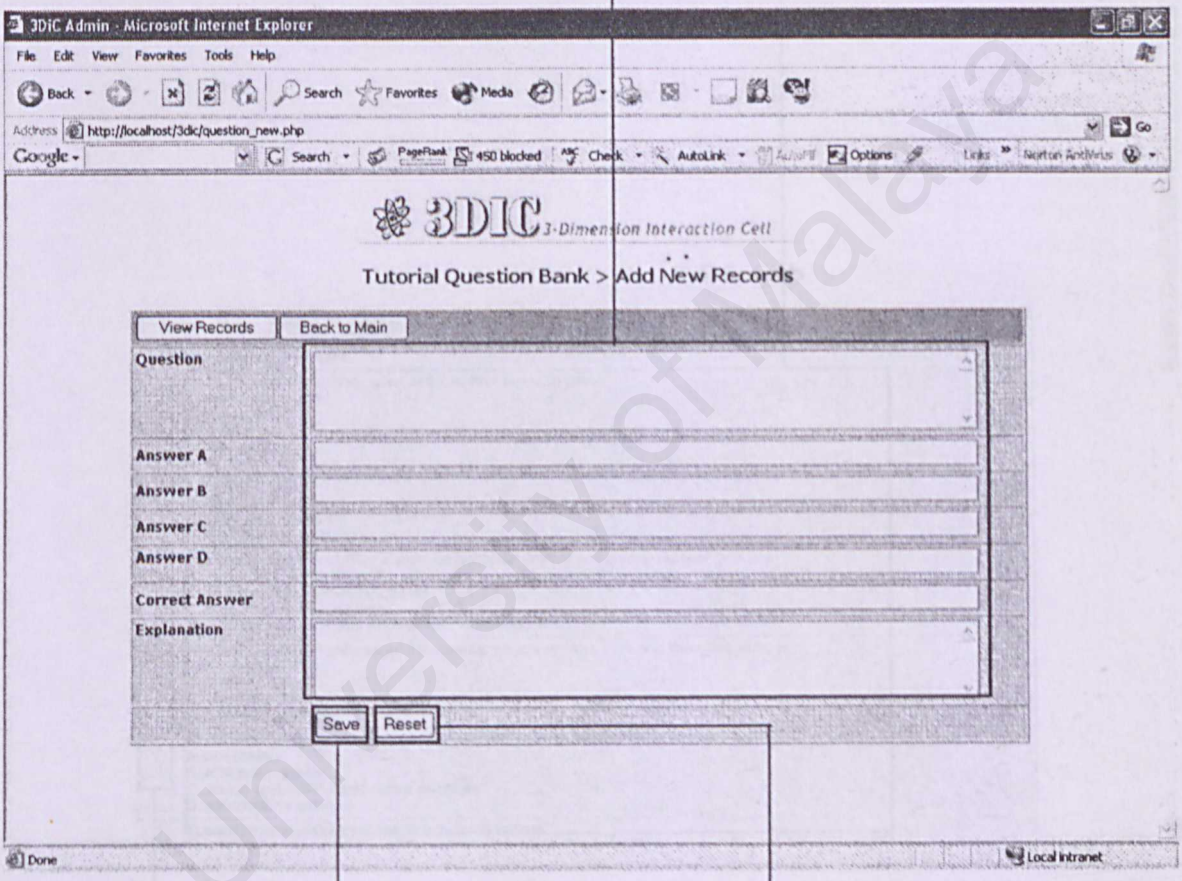
5.5 View/Edit Users Record



Click on the delete button in order to delete the checked user's record.

5.6 Add New Tutorial Questions

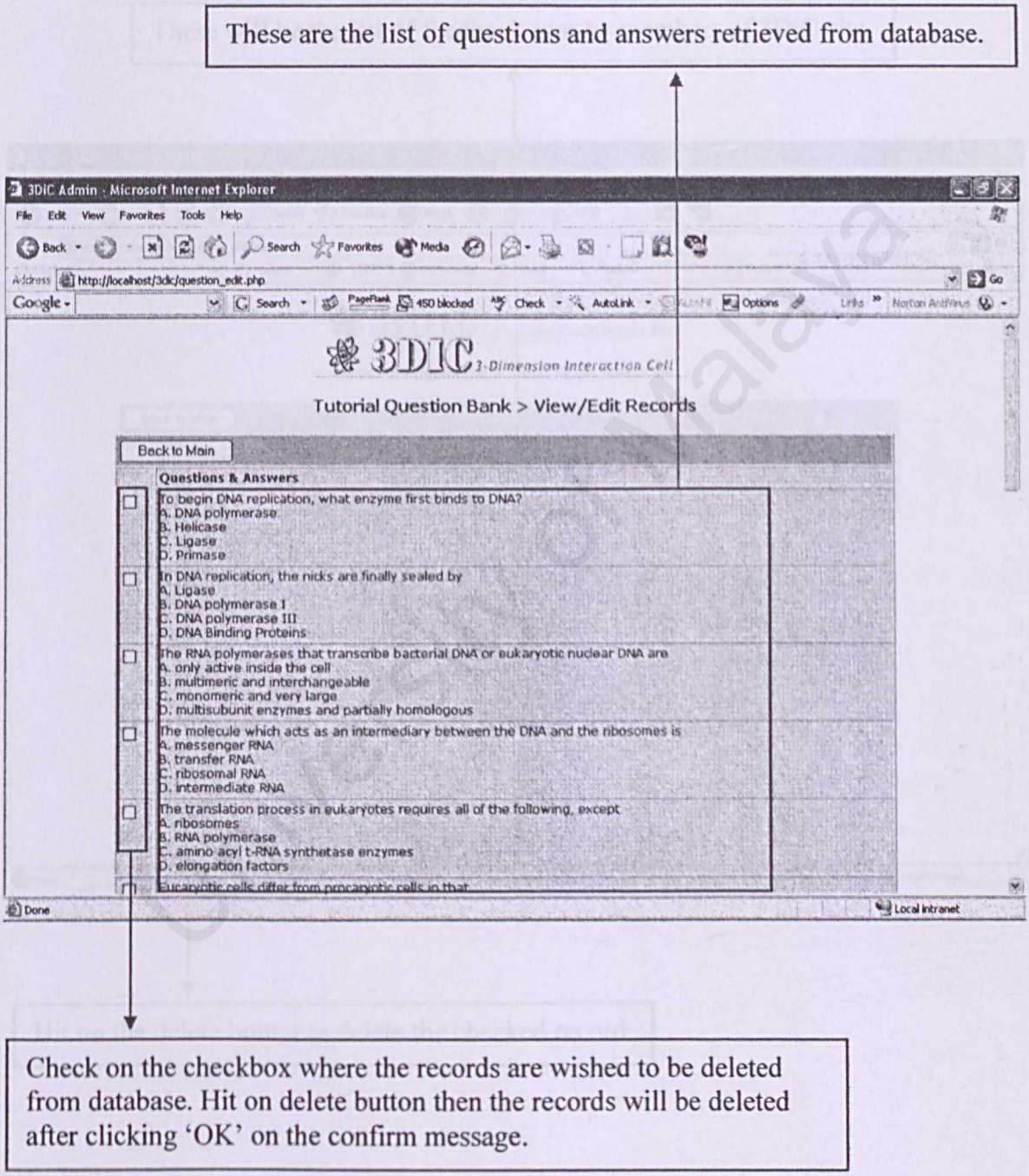
Enter the questions and answers for option A, B, C and D into the fields provided. Enter the correct answer as well and the explanation for it.



Click on the save button to save the new questions and answers added.

Click on the reset button to reset the form to its default values.

5.7 View/Edit Tutorial Questions



5.8 View/Edit Feedback